Specialized Oil Publications of
THE GULF PUBLISHING COMPANY
Box 2608, Houston (1), Texas

WORLD OIL and The COMPOSITE CATALOG
for the drilling-producing-pipe line industry

PETROLEUM REFINER and The REFINERY CATALOG
for the refining-natural gasoline industry

RAY L. DUDLEY, *President, Publisher*
A. L. BURNS, *General Manager*

EDITORIAL STAFF

WARREN L. BAKER, *Editor*
AL REESE, *Managing Editor*
L. J. LOGAN, *Associate Editor*
ELTON STERRETT, *Engineering Editor*
GEORGE O. IVES, *International Editor*
J. E. KASTROP CECIL SMITH M. C. MARQUEZ
MARY E. POOLE, *Librarian*
3301 Buffalo Drive, Houston 6, Texas

HENRY OZANNE
250 Park Ave.
New York 17, N. Y.

GILBERT M. WILSON
W. W. Wilson Bldg.
Huntington Park, Calif.

ANTHONY GIBBON
Hunt Bldg.
Tulsa 3, Okla.

E. N. TIRATSOO
15 Redcliffe Gardens,
SW 10, London

ADVERTISING STAFF

TOM W. NELSON, *Advertising Manager*
RANDALL BROOKS, *Assistant Advertising Manager*
ROGER MOTHERAL, *Eastern Advertising Manager*

NELSON BIGELOW
FRANK VICKREY
250 Park Ave.
New York 17, N. Y.

BILL WESTFALL
1010 Euclid Ave.
Cleveland 15, Ohio

H. G. FITZPATRICK
332 S. Michigan Ave.
Chicago 4, Ill.

BILL ATCHESON
Hunt Bldg.
Tulsa 3, Okla.

J. W. CURTS
W. W. Wilson Bldg.
Huntington Park, Calif.

CHARLES WYATT
3301 Buffalo Drive
Houston 6, Texas

CIRCULATION DEPARTMENT

CLINTON S. QUIN, JR., *Manager*

Published every month except semi-monthly in February. Single copies 50 cents (except special issues). Subscription price: domestic and foreign, $2 a year; 2 years, $3; 3 years, $4. Advertising rates on application. Copyright, 1949, by The Gulf Publishing Company.

Indexed by Industrial Art Index and Engineering Index

FOR A
Happy New Year

UTILIZE THE THOUSANDS OF HELPFUL IDEAS WHICH ARE PRESENTED REGULARLY IN WORLD OIL. IF YOU ARE NOT A SUBSCRIBER IN YOUR OWN NAME, USE THE PERSONAL ORDER FORM ON PAGE 276.

ABC **WORLD OIL** HBP

Established 1916 as THE OIL WEEKLY

CONTENTS

January, 1949 **Vol. 128, No. 9**

CURRENT OUTLOOK SECTION

Publisher's Page — *Ray L. Dudley* — 21
The Changing Panorama — 23
Looking Ahead — 24
Monthly News Analysis — 25
Completions Total 35,808 for 11 Months — 30
Great Strides in Conserving Texas Casinghead Gas — *Warren L. Baker* — 32
The Foremen Will Come to Order — *Al Reese* — 35
Unitization of Areas Involving U. S. Lands — *John R. Moran* — 39
Dispersion of Facilities Sought for National Security — 44
Petroleum Trends—Record Output Increases Crude and Product Stocks — *Cecil Smith* — 46
Shell Starts to Prove Rich Condensate Area — *Anthony Gibbon* — 48

EXPLORATION SECTION

The Poulter Method of Geophysical Seismic Exploration — *J. E. Kastrop* — 53
Exploratory Drilling Continues to Find Many New Sources — *Cecil Smith* — 62

DRILLING SECTION

Surface Recording Pressure Bomb and Fluid Sampler Feature Testing Tool — *W. C. (Hut) Erwin* — 71
Remote Control Power Tongs and Pipe Racker Lessen Crew Fatigue — *J. E. Kastrop* — 76
Mechanics of Drill-Stem Testing *(Last of Two Parts)* — *Roy E. Edwards* — 82
Simplified Design Calculations for Combination Casing Strings — 87
Combatting Drill Stem Corrosion — 88
Causes and Prevention of Drill Pipe and Tool Joint Troubles *(Fourth of Six Parts), H. G. Texter and R. S. Grant (Revised by H. G. Texter and S. C. Moore)* — 90
How to Do It—Drilling Hints — 106

PRODUCTION SECTION

Permeability Trends from Reverse Circulation Bit Cuttings — *N. P. Whaley* — 121
Successful Gas Repressuring in North Texas — *Roland Gouldy and Gordon R. Stine* — 126
Plastic Squeeze Jobs in Kansas Wells — *L. L. Terry* — 140
Application of Secondary Recovery Methods — *J. P. Wible* — 145
Oil Production by Gas and Flooding *(Third of a Series)* — *Park J. Jones* — 150
Oxygen Concentration Effect on Flood Water Iron Pickup — *Howard A. Stoltenberg* — 154
How to Do It—Production Hints — 158

PIPE LINE SECTION

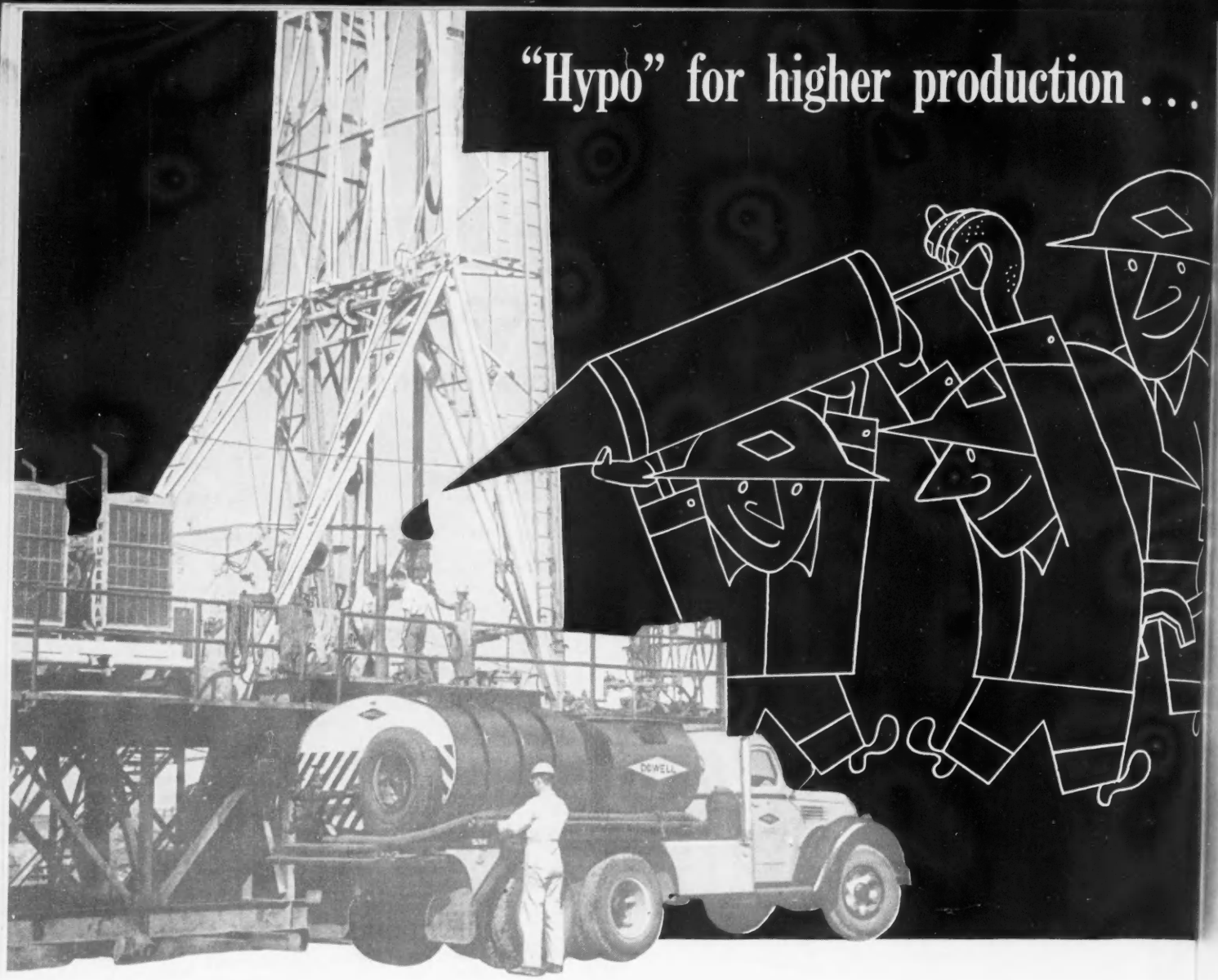
Computer for Supercompressibility Factors — *F. C. Walters* — 171
Company Drivers Are Good Will Custodians — *Elton Sterrett* — 174
Plastic Coatings and Corrosion — *C. G. Munger* — 176
Fractional and Thermal Behavior in Bearing Lubrication — 179
Colorado-Wyoming Gas Company's Pipe Line System *(58th of a Series)* — 182
Pipe Line Construction — 184
How to Do It—Pipe Line Hints — 188

INTERNATIONAL SECTION

Interesting Turner Valley Water-Flood Experiment — 197
Po Valley Gas Vital to Italy's Fuel Economy — *George O. Ives* — 200
Saskatchewan Prepares for Oil Search — *Ray E. Leigh* — 205
Huge New Tanker Fleet Being Built by Anglo-Iranian — 210
Oil Leasing Procedure in Alberta — 213
Big Increase in Middle East Production — 215
Western Canada Has Its First Dual Oil Prices — 216
Two More Discoveries for Canada's Alberta Province — 218
Germany's Exploration and Drilling Should Double — 220
Wildcat Is Best Producing Well in Southern France — 220
Venezuela Assures Safety of Foreign Oil Investors — 222

OTHER DEPARTMENTS

New and Improved Equipment Supplementing Composite Catalog — 229
Other New Equipment — 238
New Literature — 246
Letters to the Editor — 248
Associations — 250
The Oil Man's Calendar — 256
Men in the Industry News — 258
Equipment and Service Suppliers Notes — 266
New Books — 277
Squeaks from the Bull Wheel — 282
Advertisers' Index — 16
Classified Advertising (Trading Post) — 278



DOWELL ACIDIZING SERVICE . . . Proved by a 16 year recor of production increases in thousands of wells

The *right* acidizing treatment in your completion or work-over program may mean the difference between a good well and a poor one! For the most advanced methods, for the best results—"Look to Dowell", the pioneer in the acidizing of oil and gas wells.

For example, it was found that sufficient oil pressure could not be maintained above a formation packer to allow the acidizing of a bottom zone of a newly deepened well. A Dowell engineer solved the problem by adding Dowell's new acid-soluble fillers to the oil in the annulus to plug the permeable upper section of the open hole. This step enabled a working pressure of 2,000 p.s.i. to be held on the casing, allowing the treatment to be completed without further trouble. Production increased from 10 to 75 b.o.p.d.

Look to your Dowell engineer for expert help in planning an acidizing treatment to fit your well. He has at his disposal the latest techniques, the correct chemicals and modern treating tools and equipment.

DOWELL INCORPORATED
TULSA 3, OKLAHOMA
Subsidiary of The Dow Chemical Company

DOWELL

ACIDIZING SERVICE

Ask your nearest Dowell station for complete information on these Dowell services and products: Acidizing, Electric Pilot Services, Plastic Service, Chemical Scale Removal Service for heat exchange equipment, Jelflake, Paraffin Solvents and Bulk Inhibited Hydrochloric Acid.

Look to DOWELL

FOR OIL INDUSTRY CHEMICAL SERV

"Petroleum Promotes Progress"

CAPITALISM DOES IT BETTER

"THERE IS nothing that communism can do for the world that capitalism isn't already doing better," says Warner & Swasey. "Communism promises security, and delivers work-or-starve and the dreadful security of a job for life in a slave labor camp, while capitalism promises security and delivers social security, wages enabling a man to save for his future, a standard of living higher in the worst times than communism gives at its best.

"COMMUNISM PROMISES better living, and a communist has to work seven weeks to earn enough to buy a suit, while capitalism makes it possible for an American workman to buy a suit by working one week or less."

FINALLY, "COMING to think of it," asks Warner-Swasey, "what else does communism even promise? But it delivers a great deal more—ballots with only one name on them; prison camps if you stay away from work; 'homes' of one room for entire families; government-dictated wages and prices so fixed that you will never rise above a bare and barren existence; riches for a few bureaucrats who keep themselves in power, poverty for everyone else; constant fear, frustration, hopelessness which only death can end.

"AND YET there are people who call themselves Americans, working, scheming, plotting, day and night to force these 'blessings' of communism on you and your children."

RECENTLY MOST of us saw in the newspapers or magazines pictures of new automobiles which are available to Russians. The terms didn't seem to be so very high, although the one designed to be within reach of the actual workman appeared to be pretty much of a junk heap. But the payoff was in the number of such cars manufactured per year—65,000—that's all, including both the high-priced model and the low-priced one!

WE HEAR much of high profits these days, and the oil industry comes in for considerable criticism because its profits have been substantially more during the past two years than in comparable periods before.

WHEN WE hear wages referred to, we hear a lot about how little the dollar buys—well, the same thing applies to profits. It costs a whale of a lot more to find a new barrel of oil than it did eight years ago; a 10,000-barrel modern refinery costs probably 2½ times as much to build today as it did a few years ago.

IN OUR own company, we recently decided to buy replacement for a piece of equipment. The price of the equipment in 1941 was $17,000, f.o.b. factory. The present price was $45,000 at the factory!

WHAT SOME unions do not seem to understand is that when present equipment is worn out, corporations are going to have a deuce of a time buying replacements to stay in business unless they make a reasonable profit in wearing out the old equipment.

ANOTHER THING about higher profits: Total sales have increased tremendously—far ahead of any figure with which we were familiar a few years ago. Yet despite greater total profits, the profit per thousand dollars worth of goods delivered is considerably less than it was a few years ago. Any one of us could name scores of concerns who are having this experience.

OUR POPULATION is growing, more mouths to be fed, more jobs necessary to feed them. Where, in the name of common sense, will come the money for necessary expansion if profits are not enough to pay for the new factories and machines, and in the case of the oil business, to drill new and deeper wells and to provide refineries to process the oil?

WE HAVE expressed concern more than once in these pages about the plight of the drilling contracting business as an industry. Of course, we know of drilling contractors who have made a lot of money during the past few years. Some contractors would be in worse shape if they did not have production. But the industry as a whole is not in sound shape. Contractors are wearing out equipment which they will have to replace with even more expensive equipment to do the same job . . . not to mention the bigger job of deeper drilling. Oil companies paying for the drilling of wells have a stake in seeing to it that their drilling arm remains strong.

Ray L. Dudley

CLEAN UP THE "WORKING SURFACE" OF YOUR CASING

Read these facts about the Baker Rotary Casing Scraper

Have you ever tried to run testing tools or a swab, and had the rubber packing unit or the rubber cups so badly cut, torn and mutilated that the run was a failure? The chances are that trouble was caused by burrs from gunshot holes or by the sheath of hardened cement or mud which remains on the inside walls of casing, even after a bit of maximum possible gauge has been used to drill out after a cement job.

Until quite recently there was no fast, simple method of overcoming these difficulties. Now, however, it is truly a waste of time, temper and money to leave any obstructions adhering to or protruding from the "working surface" of your casing. The Baker Rotary Casing Scraper quickly, positively and economically removes *all* obstructions from the inside walls of casing, leaving the surface clean and smooth—ready for *immediate* testing and completion—and in good condition for any remedial or work-over operations *one year or ten years in the future.*

STRONG, SIMPLE CONSTRUCTION

The Baker Rotary Casing Scraper consists of a strong body in which three long, reamer-type, hard-faced blades are vertically mounted. These three blades form an expansible reamer due to the fact that they are pressed outward against the inside walls of the casing by a number of coil springs. This self-equalizing feature insures constant, uniform contact with the walls of the casing, and is one of the secrets of the clean, smooth scraping action. Hard facing is applied in a flat, rectangular recess to form the long cutting edge of each blade, and a worthwhile amount of scraping can be done before the blades are dulled.

Ample circulating areas permit free disposal of cuttings; the streamlined exterior of the body insures ease in running-in; and if by accident the Casing Scraper is run out of the lower end of the casing, there is no difficulty in bringing it back inside for removal from the well.

FACTS ABOUT ITS USE

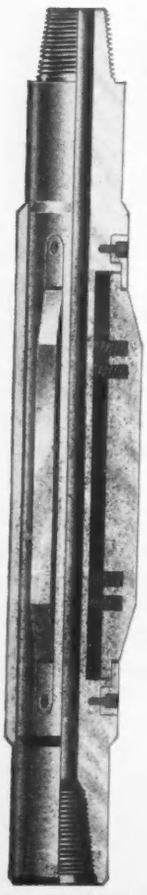
The ideal time to use a Baker Rotary Casing Scraper is while the rotary rig is still up and the crew is on hand. Install the Casing Scraper just above the bit when going in to drill out the cement shoe. Even when a bit of the maximum possible gauge is used for drilling-out, a thin, hard sheath (or skin) of cement will still remain adhering to the inside walls of the casing. The Baker Rotary Casing Scraper removes not only this hardened sheath of cement, but also scrapes away all mill scale, and smooths out rough areas. The inside of the casing is left clean and smooth, ready for trouble-free, down-hole work immediately thereafter, or at any future time.

If the well is gun perforated, then a second run of the Baker Rotary Casing Scraper will remove any burrs left around the gun-shot holes. The slight additional cost of this second run is negligible when you consider what the clean, smooth casing will mean when any future down-hole work is done.

If at a later time, after the rotary has been removed, obstructions on the inside walls of the casing interfere with operations, the Baker Rotary Casing Scraper still can be employed successfully. By running the Casing Scraper on tubing, and rotating manually with tongs, limited areas may be scraped; while several hundred feet of casing have been scraped by rotation of the tubing with an endless spinning rope, or by means of air tongs.

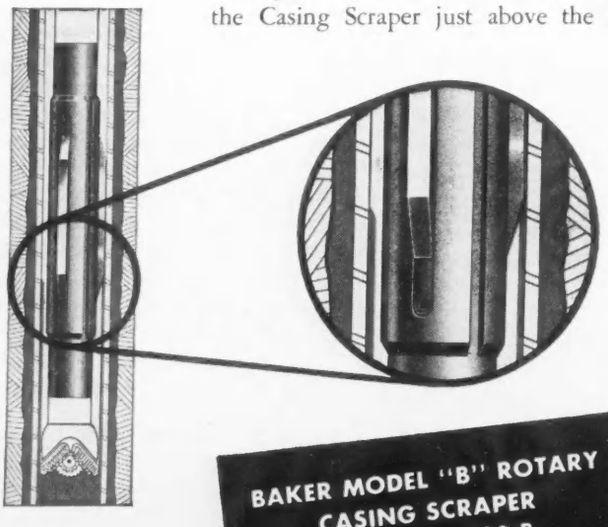
IT'S EASY TO HAVE THE "WORKING SURFACE" OF YOUR CASING IN PERFECT CONDITION

Baker Rotary Casing Scrapers are furnished on a low-cost rental basis in domestic fields, and *your* crews can run them easily and successfully to scrape the "working surface" of the casing before running casing, tubing, liners, swabs, testing tools, cement retainers, packers or other similar tools. It pays off in savings of time, temper and money.—Why not call the nearest Baker service engineer and start enjoying these benefits in *your* wells?



(Left) With only four springs back of each blade, burrs from gunshot holes are readily removed.

(Below) Notice the "trouble-making" sheath of cement left behind the bit, and how the blades remove it.



BAKER MODEL "B" ROTARY CASING SCRAPER
Product No. 620-B

BAKER OIL TOOLS, INC. LOS ANGELES • HOUSTON • NEW YORK

The Changing Panorama

Controls Cause Gas Industry Troubles

SINCE NATURAL GAS and oil are so closely related, conditions affecting gas are of great importance to the petroleum industry, and some of the problems of the natural gas industry call for active study and work by oil industry men and organizations.

Heading the list of serious problems of the gas industry is that of repressive government control. On every hand, the gas industry runs into laws, regulations, and orders that fence it in and make ceilings on its activities. Although using private capital and assuming large risks, the gas industry is denied much of the freedom and opportunity for profit generally accorded to private industry. Root of the problem lies in arbitrary fixing of prices for gas by governmental agencies and allied arbitrary determination of ceilings on possible profits.

Out of that fundamental handicap comes much of today's trouble for the gas industry. Demand for gas is so great that the industry has no hope of fulfilling it. Pipe is not available in sufficient volume to build enough pipe lines to meet the demand. But even if pipe were plentiful, the question arises as to the soundness of investment in the many new gas lines needed. Available to feed the lines should be large gas reserves, and though reserves are substantial, field prices of gas do not encourage exploration for additional reserves.

Prices of gas are far out of line with prices of other fuels, being artificially and uneconomically low with the result that demand for gas is artificially high. Almost everyone will concede that gas prices are too low, but they stay that way because they are fixed arbitrarily and not by the laws of supply and demand and competition. In the effort to make sure that consumers are not charged too much, they are charged too little, and other potential consumers, though willing to pay fairer prices, are denied the right to do so and are left unsupplied.

This shackling of the gas industry is of more than academic interest to the oil industry. There are constant efforts in political circles to include the oil industry in the regulations binding the gas industry.

Knocking at the oil producer's door is the idea that the federal government can control the production of gas that goes eventually into interstate commerce. It is only a very short step to control production of oil. An unsuccessful effort was made in Congress in 1948 to obtain passage of a law that would explicitly assure freedom of gas producers from federal government control. For their own sake as well as that of the gas industry, oil producers will want to see this remedial legislation enacted in 1949.

Storage Facilities Being Added by Gas Industry

INSTALLATIONS of underground storage of natural gas in buried pipe are becoming an important factor in districts serving metropolitan areas where underground reservoir conditions are not satisfactory for natural gas storage purposes. For example, in the Chicago area, natural gas utility companies have in use and are now constructing facilities capable of storing 30 million cubic feet, a nice backlog in the event of breaks or exceptionally heavy loads during extreme cold weather.

Just two years ago the Public Service Company of Northern Illinois completed its first such installation near Kanakee (WORLD OIL, September, 1948). Its capacity was 1¼ million cubic feet. During 1947 and 1948 the company has increased its underground storage in service to more than 95 million cubic feet, all at 2240 pounds pressure. In addition to the Kankatee storage, the company now has 74 million cubic feet capacity installed near Mt. Prospect, Ill., and 20 million cubic feet near Matteson, Ill. Another 46 million cubic feet are expected to be added during 1949 at the Mt. Prospect site. Thus, by the end of 1949, the present 95 million cubic feet in service will be increased to more than 141 million cubic feet.

Railroads to Use Less Oil by Shift to Diesels

IN THE next ten years today's 35,000 steam locomotives on U. S. railroads will be replaced by 20,000 diesel-electric locomotives, forecasts the head of a large company now making only diesel-electrics. Full dieselization of all U. S. railroads will reduce, not increase, fuel oil used by locomotives, he said. Of existing 35,000 steam locomotives, 7000 burn oil, each consuming many times more than a diesel-electric. U. S. railroads currently consume 227,485 barrels of fuel oil daily. With complete dieselization only 170,343 barrels per day of diesel oil would be required, it is estimated.

Large savings in locomotive operating costs are responsible for the revolution in railroad motive power. Last year 3 percent of the switch engines were diesel-electric but they did 33 percent of the work. Four percent of freight locomotives were diesel-electric but produced 15 percent of gross ton miles. Thirteen percent of the railroad passenger locomotives were diesel-electric but hauled 42 percent of the passenger train miles.

By the time today's children take their places in railroading, steam locomotives will be virtually extinct, it is predicted. It will then be unprofitable to continue operating remaining steam units even if they are not worn out, it is explained.

Humble Bestows Credit With Yule Greetings

A FINE example of good public relations is to be seen in the Christmas greeting cards sent out by the Purchasing department of Humble Oil & Refining Company. Instead of the concerns which sell Humble being people who are making a profit from Humble, the Christmas card indicates that Humble feels it could not have done the job it has done during the past year without the aid of the suppliers.

A good idea and one which makes for continued good will.

Looking Ahead

● TEXAS WILL DEFEND claim to its tidelands before U. S. Supreme Court, not on states' rights basis used by California, but strictly on basis of special agreement by Texas Congress and U. S. Congress when Texas entered Union in 1846. Texas retained public lands of Texas republic, and republic's boundaries were set at three marine leagues (10.35 miles) from shore. This line was recognized also in treaty between U. S. and Mexico in 1848. While Texas also claims tidelands on same basis as other coastal states, this general claim will not be used in belief it can be upheld only through Congressional action.

● PRIVATE INTERESTS as well as Truman administration will try in courts to establish U. S. authority over offshore lands. Two new suits were filed in late December in federal district court at Washington. Plaintiffs want drilling rights off California coast. They seek to compel Secretary of Interior to issue tidelands exploration permits under Mineral Leasing Act of 1920. They say they applied for permits in 1939 and again after Supreme Court decision in California tidelands case but permits were denied. Similar suit filed in early 1948 in same court is being held in abeyance pending new developments in California tidelands case. Efforts to get Congress to pass law requiring federal leasing of tidelands will meet strong opposition.

● TOTAL DEMAND for all oils in 1949 will average 6,548,000 barrels daily, up 5.8 percent from the 6,191,000 daily of 1948 and comparing with 5,900,000 daily in 1947, forecasts U. S. Bureau of Mines. Domestic demand will be up 6.4 percent, with gains of 8 percent for motor fuel, 12 percent for distillate fuel oil, 10 percent for kerosine, 6 percent for miscellaneous, and decrease of 1 percent for residual fuel. Gain of only 2.4 percent in new supply will be needed, as additions to stocks will not be necessary, whereas 3 percent of new supply in 1948 increased stocks. Imports are expected to increase to 548,000 barrels daily from 505,000 daily in 1948.

● BUSINESS IN GENERAL will be good in 1949 despite adjustments and fluctuations, forecasts Herbert E. Smith, president of United States Rubber Company. Keeping business at high level, he says, will be (1) full employment, high wages, and large purchasing power; (2) heavy government spending for defense and European program; (3) large spending by industry for expansion and modernization; and (4) demand exceeding supply in some durable lines, accentuated by government purchases.

● SUPPLIES of petroleum products on West Coast will be sufficient to meet all normal requirements, National Petroleum Council concluded after carefully watching clearing up of critical situation caused by prolonged strikes in area.

● DECREASE OF CRUDE PRICE by $1 per barrel from present level would seriously curtail or even halt present Gulf Coast offshore development, stated two engineers of Humble Oil & Refining Company. Offshore operations cost from three to five times as much as those on land, they said.

MONTHLY NEWS ANALYSIS

U. S. CLAIMS TEXAS-LOUISIANA TIDELANDS . . . SUPPLY ADEQUATE TO MEET 1949 REQUIREMENTS . . . NECESSITY FOR FAVORABLE PROFITS STRESSED . . .

Long and Determined Fight Over Tidelands Indicated

The question of tidelands ownership is due to be debated hotly and fought over in the courts and in the legislative halls before the rights of the states and the powers of the federal government are determined.

Attorney General Tom Clark shortly before Christmas instituted action before the U. S. Supreme Court against Texas and Louisiana, claiming lands off the shores of those states for the U. S. government. The suits are similar to that against California, in which the Supreme Court ruled that the federal government had "paramount" powers over submerged lands within the 3-mile belt beyond low-tide. The suit against Texas concedes that Texas entered the Union under special conditions with regard to public lands but claims that the federal government assumed authority over the marginal sea. The Supreme Court was in recess, and while it will meet again January 3, it may not act on this case for at least several weeks thereafter. State officials of both Texas and Louisiana have asserted their determination to put forth a vigorous defense of the rights and property of their states.

Clark stated that the Truman administration was considering rewriting its Tidelands control bill. As introduced in the last session of Congress it would have directed tidelands oil revenues to conservation and reclamation purposes, with states adjacent to offshore fields receiving substantial shares. Contemplated new measure would use revenue primarily as federal aid to education in all states.

In a press conference, President Truman emphatically declared that he would actively seek enactment of a law calling for federal government administration of the lands beneath the marginal sea.

However, such a bill certainly will encounter strong opposition, as it threatens rights to natural resources as regards inland states as well as coastal states. Instead of the administration bill, there will be strong efforts to enact a bill under which the federal government would withdraw claim to the tidelands and recognize the claims of the states, as traditionally upheld in the past. Such a bill is conceded a good chance of passage in the House of Representatives and some chance of enactment in the Senate. It is now indicated, however, that President Truman certainly would veto it. There is some doubt if the House would override such a veto and great doubt that the Senate would do so.

In view of these strong conflicting views and forces, it seems quite likely that in 1949 there will not be any legislation consummated on this controversial question.

However, some of the advocates of quitclaim legislation cling to hopes of success. Especially active in the matter is the National Association of Attorneys General. In a meeting in Houston that organization adopted a resolution calling for a vigorous fight to uphold the rights of the states to the tidelands. With 43 attorneys general in attendance, the resolution was adopted with only one dissenting vote—that of Attorney General J. E. Taylor of Missouri. The resolution also opposed any legislation to authorize the federal government to lease lands beneath navigable waters. It directed the president of the association to appoint a committee of 7 attorneys general to draft appropriate legislation and carry to Congress the fight for state ownership of the submerged lands. The resolution recognized federal authority over the tidelands only during national emergencies.

Recognition of state ownership by Congress is necessary, the resolution declares, to avoid endless litigation, loss of taxes, and "possible future attempts of federal agencies to usurp powers in submerged lands."

The association of attorneys general will cooperate with the National Governors' Conference and Council of State Governments in promoting the rights of the states.

Industry Thought Capable Of Meeting 1949 Demands

The petroleum industry is in a position to meet total demands during 1949, concluded the Economics Advisory Committee of the Interstate Oil Compact Commission in a report presented at the commission's winter meeting at Wichita, Kansas, December 9. In the third and fourth quarters of 1948, consumption of oils, especially bunker oil, was retarded by shipping strikes on East and West Coasts and by the California refinery strike, the committee stated.

In addition, it added, there appears to have been some slackening in the rapid growth of demand that occurred in 1947 and the first half of 1948. On the supply side, said the committee, the industry now is securing the benefits from its vigorous expansion efforts since the war, and the rate of growth of increased supply is greater than the rate of growth in demand.

Total petroleum demand for the year 1949 will be nearly 6 percent greater than in 1948, the committee estimated, and will average 6,517,000 barrels daily.

The committee revised downward by 3 percent the demand estimate made in its report of August 31 for the winter of 1948-1949, and declared that it now anticipates demand during the present winter will be 4 percent higher than that of a year ago, assuming normal weather conditions and continuation of good business generally.

The report revealed that petroleum inventories in the United States increased during 1948 by approximately 230,000 barrels daily, and it is believed that adequate working stocks have been reestablished.

The supply of all oils, domestic and foreign, required to meet the anticipated demand of 6½ million barrels during the entire year of 1949 will be somewhat less than was supplied in the fourth quarter of 1948, the report said. The required supply during the first quarter of 1949 is about 190,000 barrels a day below current levels. The committee assumes that

imports will be approximately 545,000 barrels daily during 1949, and if this quantity of oil is received from foreign sources, and if demand and stock changes conform to the estimates included, domestic production of crude and natural gas liquids should average 5,550,000 barrels daily and 420,000 barrels daily, respectively.

In conclusion, the committee reported that the major change in the outlook for 1949 as compared to 1948 is that there does not seem to be any necessity to continue to increase inventories of crude and its products. In 1948, the report pointed out, such inventories actually increased about 230,000 barrels a day, or 84,000,000 barrels. This means that in 1948 new production and other new supplies were made available over and above the demand for current consumption. Now that this rehabilitation of inventories has been accomplished, the 230,000 barrels per day of new supplies which were used for these purposes in 1948 can be utilized to supply a large share of the increase anticipated in the demand for 1949.

Profits Made Possible Increase in Oil Supply

The necessity of favorable profits for satisfactory performance of the petroleum industry was brought out convincingly at Washington recently in testimony before a sub-committee on profits of a joint Congressional economic committee studying business earnings.

An excess profits tax imposed upon industry at this time would have the same effect as a law directly prohibiting further industrial expansion, warned Robert G. Dunlop, president of Sun Oil Company. Mere talk of a so-called excess profits tax is already causing grave doubts about the wisdom of moving ahead with projected plant expansion programs, he asserted.

The oil industry traditionally has depended upon profits to generate funds for expansion, Dunlop stated. This "internal creation of capital" is especially needed today, he said, "because current rates of taxation and credit restrictions place limitations on the availability of outside financing." Profits, he explained, enabled the oil industry to spend $2 billion a year during the last two years to build new plants and facilities that were urgently needed.

"Are the proponents of the proposed excess profits tax willing to take the responsibility of halting this expansion?" he asked. "Are they ready to tell the American people that we have all the plant and equipment we need to insure our national security and our standard of living?"

Dunlop emphasized that the oil industry's vast postwar expansion was made possible largely by the willingness of stockholders to forego dividends to help finance new construction. Increased prices have had the effect of increasing supplies of oil, and this is what the consuming public has desired, he said. While increased "dollar profits" have resulted from these prices, he continued, the higher profits have made possible tremendous expansion programs to meet consumer demands.

However, added Dunlop, there may be in prospect a lessening in requirements of capital for expansion and a possibility of lower oil prices. "Although it is perhaps too early to be definite about it," he stated, "we may be entering the final phase of economic cycle, with supply outrunning demand and reduction of oil prices and oil profits in prospect. In my opinion there is much evidence to support this point of view."

Eugene Holman, president of Standard Oil Company (New Jersey), told the committee that if oil companies had not made very great expenditures for new facilities, there would be rationing of oil in this country right now. Thus an important beneficiary of oil company profits has been the public, he contended.

Profits of the American petroleum industry have not been excessive, asserted Dr. Joseph E. Pogue, economist and vice president of Chase National Bank, in his testimony before the Congressional committee.

"In all times, inflationary or normal," said Pogue, "the most effective criterion to apply in the judgment of profits is their adequacy or inadequacy in the process of capital formation. Our entire economy is dependent on the formation of sufficient capital funds to maintain and expand the country's productive capacity. As capital costs rise, profits are called on to supply increasing amounts of these funds."

For illustration, Pogue said that 1947 profits of 30 oil companies representing a highly typical section of the industry reached $2160 million, while another $743 million was obtained through borrowing and sale of assets. Of this combined total, he said, $2076 million, or 71 percent, went for capital outlays.

Pogue expressed the opinion that "if capital expenditures (which are dependent on earnings) had been less, the oil shortage last year would have been prolonged.

Earnings during the so-called "peak" year of industry profits, said Pogue, played an essential part in capital formation.

Pogue said he believes a decline in oil companies' earnings is indicated, with a consequent decrease in capital formation to be expected. Profits will adjust themselves to the lower level of requirements, as the mechanism of the market reduces profit margins, he predicted.

He further emphasized that profits are overstated in an inflationary period by the failure of reserves for depreciation and depletion to reflect fully the true rise in replacement costs. When adjusted to the realities of replacement costs, he said, the real profits of the 30 petroleum companies whose statements he had analyzed were $382 million less in 1946 and $763 million less in 1947 than formally reported.

Pogue also pointed out that the rate of return to the oil companies on the basis of their present investment is not a yardstick of sound condition because these investments have been made previously, while income is derived currently. Rate of return is figured by establishing the ratio of current net income to accumulated borrowed and invested capital, or to invested capital soley.

"But," he explained, "if the two sets of dollars differ substantially, as they do when inflation intervenes, then the ratio not only is false, but one commits a mathematical error even in computing it"

Lack of Capital Is Threat To Future of Business

The increasing lack of equity capital in all American industry is becoming a serious threat to plant expansion, according to several studies presented recently at the annual Congress of American Industry, sponsored by the National Association of Manufacturers, in New York City. Many authorities believe the danger is particularly great for the petroleum industry, which has projected a $5 billion expansion program for 1948-1949, and a $13 billion expansion worldwide over the next four years.

Joseph Morrell Dodge, president of the Detroit Bank, explained the situation in these words:

"With a declining rate of savings, an artificially low interest rate and new equity capital not coming into business, there is doubt about where our future capital is coming from and how we can

Order Your Copy of 1948 World Oil Index

The complete editorial index covering all issues of WORLD OIL published during 1948 has been prepared and is bound separately in convenient pamphlet form. It will be sent free to all subscribers who write requesting copies.

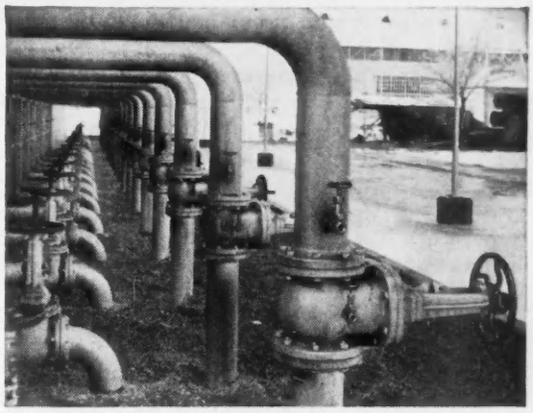
Orders should be addressed immediately to the Circulation Department, Box 2608, Houston 1, Texas, as quantities are limited.

IT PAYS TO CALL CRANE first ...FOR EVERYTHING IN PIPING

That's the surest way to get whatever you need, whether it's valves, fittings, shop-fabricated units, pipe or accessories. When you buy at Crane, you deal with the world's most complete source of piping equipment. So why shop around? **One Catalog** gives you comprehensive selection, in brass, iron, steel, and alloy materials. **One Order** brings prompt delivery through your nearest Crane Branch or Wholesaler.

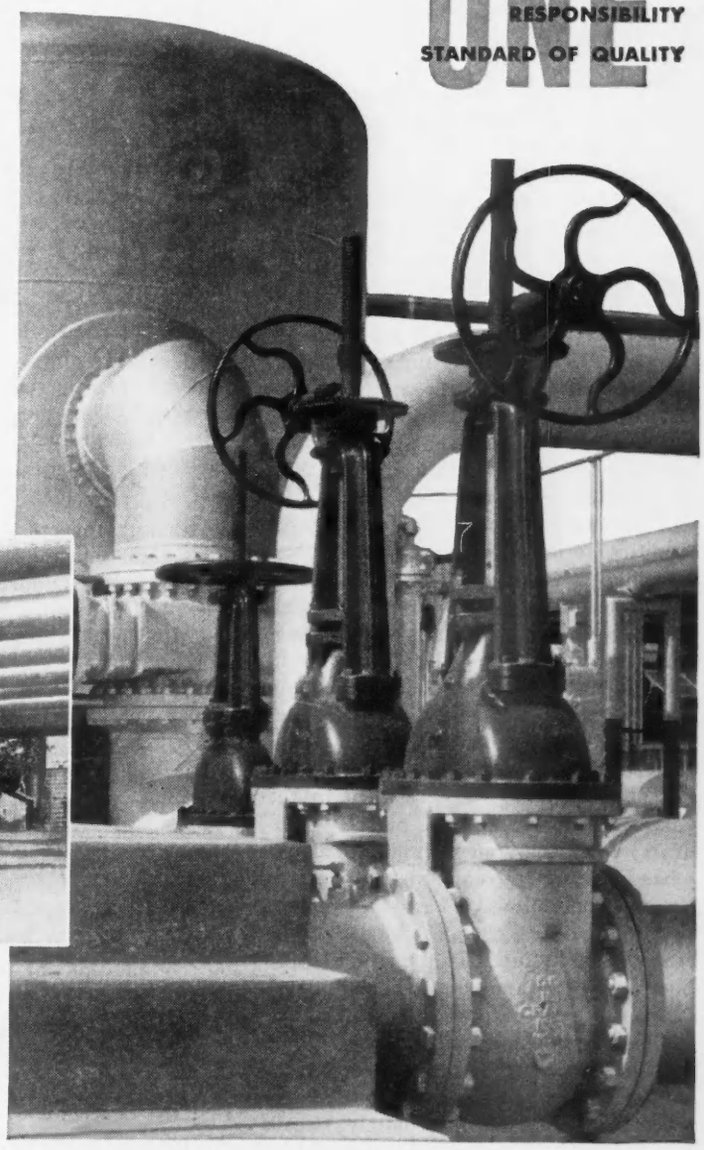
To standardize on Crane as **One Source of Supply** not only saves time, it simplifies every piping procedure—from design to erection to maintenance. **Undivided Responsibility** for all materials delivered to the job helps you get better installations, avoid needless delays. **High Quality** in every item from Crane assures uniform dependability in every part of piping systems.

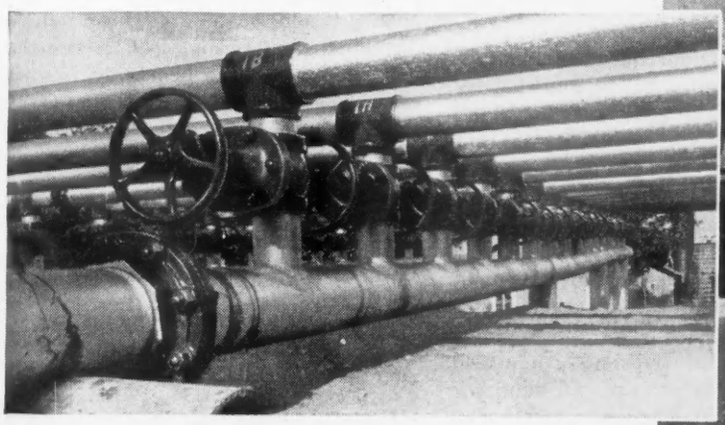
Crane Co., 836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving All Industrial Areas



COOLING TOWER LINES *featuring Crane 200-pound W.O.G. iron body double-disc gate valves.*

ONE
SOURCE OF SUPPLY
RESPONSIBILITY
STANDARD OF QUALITY





CRANE VALVES *and fittings on manifold in field gathering system.*

GAS LINES *in natural gas plant, equipped with Crane 16-in. 150-pound W.O.G. iron body gate valves, gear operated.*

EVERYTHING FROM . . .

VALVES
FITTINGS
PIPE

CRANE

PLUMBING
AND
HEATING

FOR EVERY PIPING SYSTEM

continue to expand enterprise and production. The shortage of new capital threatens the continuation of the present level of employment and production and further expansion of output, the development of new products, and our ability to absorb some 500,000 new workers each year.

"During a time when the need for resources for investment to expand production has been greatest, government has been using far too large a part of the total resources of the community for too long a time for its own purposes, and proposes to use even more. New enterprise, whether large or small, has not been easily capitalized. Established business has had to depend more on borrowing and less on capital. Industry has been forced to resort to banks and insurance companies to meet normal capital needs, instead of acquiring its need for capital from the savings of the people. This is not a healthy condition and is not a healthy director for the future development and stability of our economy."

This shortage of new capital, unless relieved by higher corporate earnings or investment by the public, will cut national production this year by $15 billion, or 7 percent, warned Morris Natelson, head of the industrial department of Lehman Brothers, investment bankers. He added: "The real threat to maintenance of our present economic status, the shortage of capital, has probably not as yet been generally recognized as a problem. Rising wage bills and prices will throw a financial strain on communities to meet increased capital requirements. Eventually wage increases and consequent price rises will outrun the ability of our financial system to sustain them and there will be a decline in the volume of capital goods production, unemployment and a decline in the demand for consumer goods.

According to the annual studies of Dr. Joseph E. Pogue, vice president of the Chase National Bank, the petroleum industry has generated during the last 15 years most of its required capital from its own operations. There is evidence that this trend is changing sharply. The recent $250 million loan negotiated by Shell from insurance and financial houses is the largest corporate borrowing in the history of American business. Other oil companies are turning to banks for capital availability to finance the huge expansion projects immediately ahead. For instance, Standard Oil Company (N. J.) and Socony-Vacuum Oil Company, two of the largest units in the industry, are resorting to loan programs in connection with the stepped-up production and pipe line plans of the Arabian American Oil Company in which Jersey Standard and Socony are now partners.

Dr. Pogue's analysis shows that from 1934 to 1947, the most representative portion of the oil industry generated internally 12,605 million while capital expenditures totaled $12,710 millions, practically a balance. Several industry economists fear that unless larger equity offerings are accepted by the investing public, the petroleum industry will be severely handicapped in fulfilling its five-year expansion program.

Representative Daniel A. Reed of New York, in a report to the Congress of American Industry, put the matter this way: "I deplore the disappearance of venture capital, now vanished because it depended on the people and the people have none because they cannot save."

Crude Price Raises of 35 Cents a Barrel Withdrawn

Difference of opinion among major purchasers as to the correct level for crude oil prices was resolved December 17 when Phillips Petroleum Company and then Sinclair Oil Companies reduced their postings 35 cents a barrel, canceling the 35-cent increases that had been made by Phillips on September 28 and by Sinclair on November 24. Several smaller companies that had raised prices along with Phillips and Sinclair also followed them in reducing postings December 17. Thus there was a general acceptance, finally, of the crude prices that prevailed prior to the Phillips 35 cent raise in September.

Although the crude market was relatively tight when Phillips posted its increases, supplies subsequently came into better balance with demand, and scarcity was not sufficiently acute or widespread to force other major purchasers except Sinclair to meet the Phillips schedule. Sinclair had met Phillips prices November 24, explaining that it needed additional crude and had to agree to pay the higher prices in order to buy it. But in the following weeks crude became easier to obtain, as demand for oil products noticeably leveled out and crude and products went to storage. Demand for domestic crude also began to be affected by competition of foreign oil, which became more readily available on a spot basis.

K. S. Adams, president of Phillips Petroleum Company, expressed regret that the company was forced to reduce its prices to the levels paid by most other purchasers, because it believed higher prices necessary to cover increased costs and to assure continuing adequate supply of domestic petroleum.

"Only through an unusual combination of circumstances has today's apparent supply-demand balance been accomplished," Adams stated. "Imports of oil have increased sharply and now are over one half million barrels daily. At the same time, exports have decreased. During the recent shipping strikes on the East and West Coasts oil consumption was drastically reduced. A year relatively free from work stoppages in the coal industry provided an increase in supply of that fuel. Unseasonably warm weather throughout the principal heating-oil consuming areas held shipments far below normal."

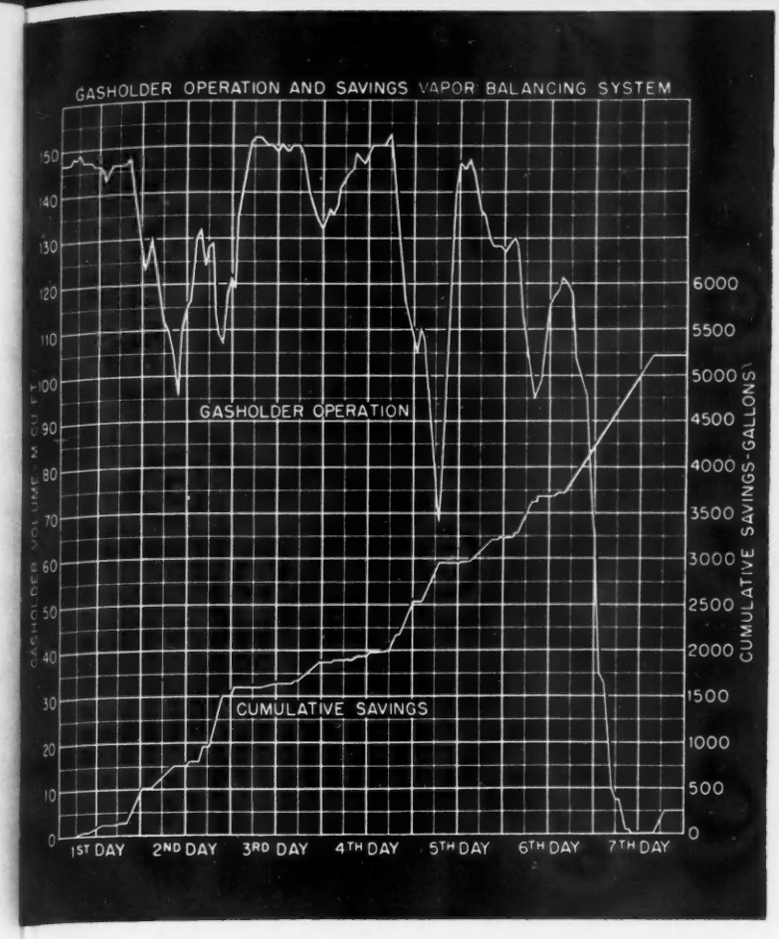
Adams questioned whether the supply-demand balance reached through this combination of events would assure continued sufficiency of supply. He emphasized that oil industry costs are very high, and said "it is our conviction that the higher crude price we are now withdrawing is essential to cover the greatly increased costs." Adams declared that "Even at the moment, our own country's record crude production cannot supply our domestic requirements. If deprived of the more than one half million barrels daily of imports, this country would immediately face an unprecedented oil shortage. A foreign oil supply thousands of miles away is a slender thread on which to hang our national security in these days of strained international affairs."

Doubt about the continued sufficiency of supply is not shared, however, by many others in the industry. For example, the Economics Advisory Committee of the Interstate Oil Compact Commission in its report of December 9 at Wichita, Kansas, predicted that the industry would be able to meet all demands encountered in 1949. It said that the industry now is benefiting from its vigorous expansion efforts since the war and that supply recently has been increasing more than demand.

Compact Speakers Point to Gas Conservation Efforts

The program for the winter meeting of the Interstate Oil Compact Commission at Wichita, Kansas, December 9-11 laid emphasis on matters pertaining to conservation of natural gas. Speakers called for opposition to federal control of natural gas production, fair prices for natural gas at the wells, continued efforts to reduce waste of casinghead gas, and increased application of gas and oil conservation measures.

Governor Frank Carlson of Kansas issued a plea to all oil and gas producing states to adopt strong policies opposing federal control of natural gas production. He warned that the trend during the past few years has been in the direction of greater federal control and that federal agencies are seeking to occupy fields of regulation heretofore reserved to the states.



Extracting Gold

THROUGH SAVING VAPORS

A perusal of page 11 of the new "Wiggins Vapor Balancing Systems" booklet showing a graph of the active sensitive performance of a "Wiggins Dry Seal Gasholder" together with a "Pay-Out Analysis" table will convince the reader that gold can be extracted through saving vapors.

WIGGINS CONSERVATION STRUCTURES

- Hidek Floating Roofs
- Lodek Floating Roofs
- Balloon Roofs
- Breather Roofs
- Dry Seal Lifter Roofs
- Dry Seal Gasholders

This booklet illustrates and describes the many exclusive Wiggins design and construction features of the "Wiggins Lifter Roof" and the "Wiggins Dry Seal Gasholder."

A copy should be on the desk of every executive and engineer in charge of storage of products subject to evaporation losses. Write today for your copy.

WIGGINS VAPOR SEALS
GENERAL AMERICAN
TRADE MARK

GENERAL AMERICAN TRANSPORTATION CORPORATION

135 SOUTH LA SALLE STREET, CHICAGO 90, ILLINOIS

BRANCH OFFICES: New York • Washington, D. C. • Cleveland • Buffalo • Pittsburgh • St. Louis
New Orleans • Tulsa • Dallas • Houston • Seattle • Los Angeles • San Francisco

Sub-licensees

WESTERN STATES: Consolidated Steel Corp.—Western Pipe & Steel Co. of California, Los Angeles—San Francisco • CANADA: Toronto Iron Works, Ltd. Toronto
SOUTHERN STATES: Wyatt Metal and Boiler Works, Houston — Dallas, Texas • GREAT BRITAIN: Motherwell Bridge & Engineering Co., Ltd., Scotland
FRANCE: Etablissements Delattre & Frouard réunis, Paris

Completions

Total 35,808 for 11 Months

NEW operating records by the petroleum industry became commonplace in 1948 with new peaks in crude production and refining activity being reached with almost each succeeding month. Drilling, the phase of the industry's work that makes these others possible, was also following these record-breaking trends and now as records for the first 11 months have been compiled, they show that more wells were completed and more feet of hole drilled in that period than in any previous full year.

At the end of 11 months, well completions totaled 35,808 for an increase of almost 17 percent over the wells completed in last year's comparable period. That total also topped the record 35,000 wells completed in 1937.

The greatest amount of footage drilled by the industry had been a little more than 113 million feet drilled in 1947, but that record was short-lived, for more than 122 million feet have been bored in the first 11 months of 1948.

Accomplishment of this drilling record was not an easy task. Throughout the year, tubular goods were often difficult to obtain. Many undertakings were forced into temporary suspension until operators could locate enough scarce and closely held supplies of casing and other pipe to complete the jobs. The nation's petroleum requirements were greater in 1948 than in any year of the past and the industry was called upon to supply them. With increased crude prices supporting the 1948 drilling program, this record-breaking activity was the industry's answer.

Well Completions in the United States During November 1948, and Cumulative for year.

(Figures compiled by WORLD OIL Staff from private reports and other sources as follows: Illinois from Illinois Geological Survey: Indiana from Indiana Division of Geology: Missouri from Missouri Geological Survey: Tennessee from Tennessee Division of Geology: Bradford, Kane-Clarendon, and Allegany fields of Pennsylvania and New York from The Producers Monthly.)

STATE OR DISTRICT	MONTHLY COMPLETIONS, NOVEMBER, 1948									TOTAL COMPLETIONS				CUMULATIVE TOTAL				Rigs in Operation (Drilling, Rigging Up and Shut Down)		
	NEW WELLS																			
	Oil	Dist.	Gas	Dry	Water Input	Gas Input	Water Disposal	Total New	Total Drilled Deeper	Nov., 1948	Oct., 1948	Nov., 1947	Footage Nov., 1948	Wells 1948	Wells 1947	Percent Diff.	Footage, 1948	Nov., 30, 1948	Oct., 31, 1948	Nov., 30, 1947
Alabama				2				2		2	3	3	5,042	18	26	— 30.8	92,631	5	6	5
Arizona														1			630	7	6	7
Arkansas	14			19				33		33	31	40	141,598	298	302	— 1.3	1,201,847	34	34	43
California	165			50				215	1	216	259	198	771,626	2,422	1,807	+ 34.0	8,511,950	272	288	283
Colorado	7			1				8		8	15	22	45,511	192	191	+ .5	1,037,899	30	34	67
Florida				1				1		1	4	1	3,303	25	28	— 10.7	155,177	6	4	4
Georgia												1		3	4	— 25.0	13,781			1
Illinois	109		1	101				211		211	301	213	494,177	2,255	1,904	+ 18.4	5,836,826	278	297	212
Indiana	37			50				87		87	105	61	172,767	967	572	+ 69.1	1,828,051	136	135	76
Kansas	117		11	109			3	240		240	292	198	812,421	2,733	2,372	+ 15.2	9,183,642	317	314	320
Kentucky	16		23	14				53		53	71	82	109,334	704	792	— 11.1	1,404,927	76	80	84
Louisiana	108	6	12	59				185		185	227	180	1,102,709	2,043	1,501	+ 36.1	10,079,426	208	235	200
North Louisiana	61	4	11	25				101		101	161	99	346,222	1,330	899	+ 47.9	3,674,590	68	77	73
South Louisiana	47	2	1	34				84		84	66	81	756,487	713	602	+ 18.4	6,404,836	140	158	127
Maryland														1			5,259			1
Michigan	30		1	28				59		59	90	81	141,082	674	662	+ 1.8	1,547,893	111	122	137
Mississippi	18			21				39		39	54	39	299,212	399	437	— 8.7	3,103,621	39	50	62
Missouri			2	1				3		3	9	2	1,795	51	37	+ 37.8	18,815	9	8	6
Montana	22		4	8				34		34	32	30	90,947	289	217	+ 33.2	698,448	46	66	73
Nebraska														1	3	— 66.7	4,965			1
Nevada																		1	1	
New Mexico	24		5	10				39	1	40	66	55	168,032	554	534	+ 3.7	2,259,143	125	129	116
New York	85		1		56			142		142	164	164	199,500	1,673	1,691	— 1.1	2,405,390	187	200	202
North Carolina															1	—100.0				
North Dakota																		1	1	
Ohio	34		33	49				116	1	117	134	123	250,960	1,246	1,240	+ .5	3,048,036	218	199	248
Oklahoma	200	1	18	104			2	325	7	332	441	264	1,199,384	3,822	3,347	+ 14.2	13,681,412	537	525	532
Oregon															1	—100.0				
Pennsylvania	126		24	13	109	16		288	4	292	291	310	491,403	3,075	3,212	— 4.3	5,321,987	410	412	425
South Dakota														1			1,365	2	2	1
Tennessee	3		1	11				15		15	4	4	14,875	53	17	+211.8	63,470	9	10	17
Texas	683	15	49	358	2	1		1,108	19	1,127	1,205	817	4,763,617	11,035	8,690	+ 26.9	46,858,729	1,476	1,527	1,276
Dist. 1—South Central	17			16				33		33	58	39	115,382	450	343	+ 31.2	1,363,714	39	36	58
Dist. 2—Middle Gulf	24	6	5	20				55		55	70	46	353,521	679	573	+ 18.5	4,000,156	53	64	69
Dist. 3—Upper Gulf	65	5	5	46				121		121	112	71	829,132	1,017	792	+ 28.4	6,596,825	131	148	125
Dist. 4—L. Gulf-S.W.	75	1	9	56				141	2	143	146	91	592,139	1,305	1,029	+ 26.8	6,097,789	131	144	109
Dist. 5—East Central	12			11				23	2	25	32	15	98,436	215	152	+ 41.4	1,017,382	30	31	30
Dist. 6—Northeast	26	1	8	8				43		43	42	45	239,434	372	461	— 19.3	2,007,540	45	53	57
Dist. 7-B N. Central	82		3	57				142		142	156	69	490,177	1,328	815	+ 62.9	4,232,041	210	202	105
Dist. 7-C W. Central	24			13				37		37	30	37	176,127	373	269	+ 38.7	1,615,335	67	79	59
Dist. 8—West	185		3	26				214	14	228	303	222	1,064,663	2,692	1,871	+ 43.9	12,466,847	459	474	441
Dist. 9—North	111	2		97	2	1		213	1	214	192	128	503,282	2,045	1,909	+ 7.1	5,638,168	138	127	107
Dist. 10—Panhandle	62		16	8				86		86	64	54	301,324	559	476	+ 17.4	1,822,932	173	169	116
Utah	1							1		1	1	1	1,514	18	4	+350.0	70,753	12	13	13
Virginia														1			2,301			
Washington												1		2	2		11,205			1
West Virginia	16		39	18				73		73	94	81	198,052	768	800	— 4.0	1,984,527	370	378	371
Wyoming	34			22				56	1	57	48	27	246,441	484	237	+104.2	1,972,730	138	153	93
Total United States	1,849	22	224	1,049	167	17	5	3,333	34	3,367	3,941	2,998	11,725,302	35,808	30,631	+ 16.9	122,406,836	5,060	5,229	4,871

True Measure

OF CONSISTENT EMULSION BREAKING EFFICIENCY

is the

COST PER BARREL OF DRY OIL

FIGURE your emulsion breaker cost *per barrel of dry oil produced* . . . and check Visco economy against the real cost of any other chemicals. It is a safe bet you will stick to the big Blue Barrels—or switch to them if Visco is not already giving you the lowest cost *per barrel of dry oil.*

Call your Visco Representative for expert assistance on *any* emulsion-breaking problems.

VISCO PRODUCTS COMPANY
INCORPORATED
City National Bank Bldg. • Houston 1, Texas

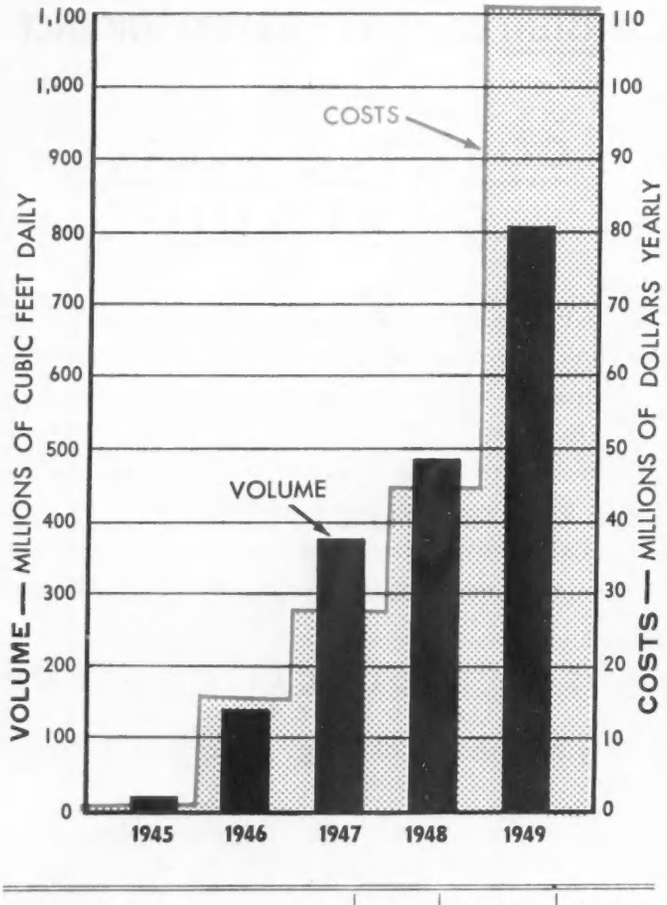
SURE SIGN OF EFFICIENT EMULSION BREAKING

NOTICE: Visco Products Company is authorized to manufacture and sell Visco Oil Treating compounds for use in the breaking and resolving of oil emulsions, and to grant licenses for such use, under the following United States patents: 1,860,562; 1,860,563; 1,912,330; 1,937,259; 2,050,639; 2,050,640; 2,206,589; 2,214,783; 2,214,784; 2,225,189; 2,303,414; 2,307,913; 2,318,034; 2,318,035; 2,321,056; 2,335,554 Re 20,717 and patents pending. Any purchaser of Visco Oil Treating compounds is authorized to use the same in the treating, breaking and resolving of oil emulsions in accordance with the above patents. The royalty for such use is included in the purchase price. Visco Products Company is authorized to and is willing to grant licenses on a royalty basis, to all companies, and to others desiring to practice the patented subject matter, under any and all of the above patents, permitting the user to purchase the oil treating compounds at will from any vendor, and to prepare the compounds for use under the above patent or patents, at a royalty charge of 20 cents per gallon. Application for license should be made to **Visco Products Company,** Houston, Texas.

GREAT STRIDES IN Conserving

By WARREN L. BAKER
Editor

Annual Costs and Utilization Volumes of Texas Casinghead Gas Conservation Projects Completed 1945-1948 and Scheduled for 1949



	Number of Projects	Daily Volume of Casinghead Gas Utilized (Mil. Cu. Ft.)	Approximate Cost for Casinghead Facilities
Completed in 1945	2	12.6	$ 275,000
Completed in 1946	18	137.6	14,992,000
Completed in 1947	32	375.7	27,693,000
Completed in 1948	30	483.9	44,795,000
Total Completed 1945-1948	82	1,009.2	87,755,000
To be completed in 1949	47	804.3	111,945,000
To be completed in 1950	9	414.0	56,655,000
Grand Total	138	2,227.5	256,355,000

OIL companies operating in Texas are vigorously engaged in a $256 million conservation program that is making remarkable progress in saving and utilizing vast amounts of casinghead gas which otherwise would be wasted. The casinghead gas-conserving program, inaugurated immediately after the end of the war, has attained particularly impressive levels during the last two years, and currently is being expanded on a more extensive scale than ever before.

As a result, the utilization of casinghead gas has grown tremendously throughout the state during the past three years. This is especially significant, since this type of gas, which is produced by oil wells, long has constituted a complex conservation program and consequently heretofore frequently has been burned in flares. Furthermore, present large-scale construction of additional necessary facilities assures that even more important strides will be made in the immediate future. Unquestionably, this is one of the most significant advancements in the history of the conservation of a natural resource. Nothing like it has been witnessed previously.

Big Building Program

A late December survey revealed that 82 casinghead gas conservation projects were completed in Texas between the close of the war and the end of 1948, 43 additional projects currently are under construction, and authorization has been given for building 13 others. When all these projects are completed in 1949 and 1950, a total of 138 casinghead gas conservation projects will have been built in the state since September, 1945, at a cost exceeding $256 million.

These new postwar plants, when all are completed, will utilize nearly 2¼ billion cubic feet per day of casinghead gas which otherwise would be flared. The survey shows that slightly more than 1 billion cubic feet of casinghead gas was being utilized daily in those newly completed projects which were operating by the end of 1948. This is in addition to using large amounts of natural gas produced by gas wells. Nearly 1¼ billion additional cubic feet of casinghead gas will be conserved daily when projects now under construction and authorized are finished in the next 18 months. Actually, this volume will be enlarged above this figure, since plans for building other new plants are being announced every month.

History's Greatest Conservation

However, even at present known levels, the postwar period marks the greatest expansion of casinghead gas conservation in history. The nearly 2¼ billion cubic feet which postwar projects will be using by 1950 is more than twice the volume that was being utilized at the end of the war. Only a little more than 1 billion cubic feet of casinghead gas was being used daily in Texas in September, 1945, although the first such plant was constructed in 1915.

This conservation program attained especially great heights during 1947 and 1948, but present construction rates assure that the volume of casinghead gas which will begin to be conserved during 1949 will far exceed either of the two previous record breaking years. The 43 projects under construction at the end of 1948 will use 959 million cubic feet of casinghead gas per day when completed. Of this number, 38 are scheduled for completion in 1949, and these will utilize 640 million cubic feet of casinghead gas daily.

In addition, there are the 13 other projects which have been authorized but on which construction work has not been started. Of these, 9 that will use 164 million cubic feet of casinghead gas

Texas Casinghead Gas

DESPITE MANY complex problems involved in utilization of this type of gas, one of the most significant advancements in conservation history is being written. When present extensive construction work is completed, more than two billion cubic feet of casinghead gas will be utilized daily by projects completed since the war. This is twice the volume in use at end of the war.

daily are scheduled to go into operation during 1949.

Thus, it is expected that 47 new projects will be placed in operation during 1949, and that they will utilize 804 million cubic feet of casinghead gas per day. Utilization of 804 million cubic feet of additional casinghead gas during 1949 will compare with an increase of 484 million cubic feet during 1948, with 376 million cubic feet during 1947, and with 138 million cubic feet during 1946.

Casinghead Gas Only

All figures used in this article are for casinghead gas alone, gas produced by gas wells having been excluded from the survey. A number of additional plants processing only gas produced from gas wells have been constructed in Texas since the war, and almost without exception all the 138 casinghead gas projects built, now building or to be constructed also will utilize large quantities of gas-well gas. In fact, many of the plants will process much greater volumes of gas-well gas than of casinghead.

The survey was purposely confined to casinghead gas, because the conservation of this gas encounters numerous serious difficulties as compared with gas-well gas which is produced only in response to market requirements or other needs. Even plant costs were allocated on the relationship of casinghead gas used to the volume of gas-well gas utilized. Hence, much larger quantities of gas are being processed in these new plants than shown and their total cost is a great deal more than indicated.

Many Complex Problems

The size of the present casinghead gas conservation program is sufficient to make it extraordinarily noteworthy, but only when consideration also is given to the numerous complex problems which must be overcome can its significance really be appreciated in the proper light. The industry, of course, is acutely aware of the problems, but they bear repeating because a lack of understanding on the part of the public has too often brought severe accusations of waste.

Fundamentally, the fact that casinghead gas is produced by oil wells makes its conservation a real problem. Its production cannot be controlled except to a very limited measure without also restricting the output of crude needed to make gasoline, fuel oil and other essential petroleum products. Unfortunately, it cannot be stored aboveground as can oil. So casinghead gas must be conserved as it is produced, and therefore its conservation necessarily becomes one of proper utilization.

In some cases it is possible to conserve casinghead gas by returning the gas to the producing or some other subsurface formation as rapidly as it is produced. However, in many cases this is not necessary from the standpoint of oil recovery operations, and in most instances it is not economically practical. Such operations require the installation of expensive compressor equipment to raise the pressure of the gas above that of the formation to which it is returned. Oil companies do not get any financial revenue from the gas returned to producing formations, but they do hope to increase the recovery of oil and, moreover, they are not wasting the gas. This plan is being used extensively in the present program.

At a recent meeting of the Interstate Oil Compact Commission, Dr. George H. Fancher of the University of Texas stated that of the casinghead gas conservation projects completed between September, 1945, and March, 1948, there

Texas Casinghead Gas Conservation Growth Since September, 1945

(Data as of End of 1948)

DISTRICT	COMPLETED			UNDER CONSTRUCTION			CONSTRUCTION AUTHORIZED			TOTAL		
	No. of Projects	Daily Volume Casinghead Gas Used (Mil. Cu. Ft.)	Approximate Cost for Casinghead Facilities	No. of Projects	Daily Volume Casinghead Gas Used (Mil. Cu. Ft.)	Approximate Cost for Casinghead Facilities	No. of Projects	Daily Volume Casinghead Gas Used (Mil. Cu. Ft.)	Approximate Cost for Casinghead Facilities	No. of Projects	Daily Volume Casinghead Gas Used (Mil. Cu. Ft.)	Approximate Cost for Casinghead Facilities
Dist. 1—South Central	..	....	.....	..	....	.....	1	17.5	6,080,000	1	17.5	6,080,000
Dist. 2—Middle Gulf	5	63.0	6,058,000	6	52.5	3,684,000	1	20.0	2,500,000	12	135.5	12,242,000
Dist. 3—Upper Gulf	16	240.9	25,773,000	5	67.0	9,800,000	1	18.0	1,215,000	22	325.9	36,788,000
Dist. 4—Lower Gulf-S.W.	19	198.5	12,565,000	11	136.8	15,385,000	1	50.0	2,500,000	31	385.3	30,450,000
Dist. 5—East Central	..	....	.....	1	7.0	3,028,000	1	5.0	2,500,000	2	12.0	5,528,000
Dist. 6—Northeast	10	43.5	863,000	1	19.0	898,000	..	....	.....	11	62.5	1,761,000
Dist. 7-B—North Central	5	31.5	2,591,000	1	4.0	1,000,000	..	....	.....	6	35.5	3,591,000
Dist. 7-C—West Central	1	25.0	4,000,000	4	136.0	12,100,000	..	....	.....	5	161.0	16,100,000
Dist. 8—West Texas	16	311.6	30,597,000	11	517.5	90,700,000	6	143.0	14,000,000	33	972.1	135,297,000
Dist. 9—North Texas	6	70.0	3,010,000	2	9.0	2,100,000	2	6.0	630,000	10	85.0	5,740,000
Dist. 10—Panhandle	4	25.2	2,298,000	1	10.0	480,000	..	....	.....	5	35.2	2,778,000
Total State	82	1,009.2	87,755,000	43	958.8	139,175,000	13	259.5	29,425,000	138	2,227.5	256,355,000

were 24 which were returning 289 million cubic feet of gas daily to underground formations. Many of the other projects completed since last March also are returning large amount to subsurface formations. Dr. Fancher predicted that when the present conservation program is completed, sufficient gas will be returning daily to producing formations to increase Texas' ultimate oil recovery by an estimated 1 billion barrels.

Casinghead gas is produced in relatively small amounts from thousands of wells scattered over a tremendous area, many remote from market. Even within a single field an extensive pipe line system is needed to gather the gas from individual wells.

Furthermore, it is usually impractical and uneconomical for a single operating company in a field to arrange for the utilization of all the casinghead gas it produces. Ordinarily, it is necessary for several operators to work out a joint program in order to form a project which is economically feasible and also to make sufficient gas available to find or attract a market. Although for years it has been possible to find sufficient markets for only a part of all the casinghead gas produced, producers long have been stripping the liquefiable contents from a large portion of the casinghead gas that contains sufficient liquids to justify processing. In September, 1948, more than 1½ billion cubic feet of casinghead gas was being processed for its liquid content daily in the state of Texas.

The only market possibilities for casinghead gas are gas pipe lines which will carry it to distant consuming markets, or in a few cases to nearby carbon black, chemical or other local industrial plants. Oil fields usually are remote from these market possibilities, but even when located conveniently many problems still exist. The constant rate at which casinghead gas must be produced and handled does not fit into the picture of widely varying consumer demands which occur with every change in the weather. Casinghead gas normally is available only at low pressures; consequently it must be gathered and compressed to boost its pressure sufficiently to put it into a pipe line.

Casinghead gas conservation operations require an enormous capital investment on which relatively little financial return can be realized under present conditions. Even with recently improved prices, partly as a result of building pipe lines to the northern and eastern areas of the U. S. and the entry of additional industry into the state, casinghead gas still brings comparatively small financial return because such high costs are necessary in effecting its utilization. Due to an excessive supply of gas, only in recent years have Texas operators begun to receive as much as 5 cents per thousand cubic feet for their casinghead gas. In 1943, the average rate for oil field gas was only 2½ cents per thousand. The average oil well in Texas produces 18,000 to 30,000 cubic feet of casinghead gas per day, and even at the new higher rate of 5 cents per thousand this is only 90 cents to $1.50 per day per well gross income from which heavy conservation costs must be deducted. Therefore, saving of casinghead gas in many fields is impractical at present-day gas prices.

The Texas Railroad Commission has displayed a keen interest in the casinghead gas conservation problem, and since 1945 has held many hearings with oil and gas operators. At these hearings the commission has urged the utilization of as much casinghead gas as seemed reasonably possible. Recently, the commission's activity in this regard has been intensified, going so far as to result in a November order shutting in 17 fields which were said to be wasting excessive quantities of casinghead gas. Some operators have contested this action in the courts on the ground that the shutdown orders were unreasonable because projects for utilizing the gas were in progress in some of the fields affected and sufficient time had not been allowed to develop plans in other cases.

As a whole, however, the industry and the commission have worked together on this important problem. The prompt inauguration of a casinghead gas conservation program following the war and the extensive scale to which it has grown demonstrate how well the industry has responded, and show that oil operators, together with the Railroad Commission, recognize the obligation to save casinghead gas whenever feasible and practical.

Despite the important economic and physical obstacles in the path of casinghead gas conservation, the achievements of oil producers in meeting this complex problem in the relatively short period since the close of World War II have been truly outstanding. Moreover, the program is being prosecuted today on a more extensive scale and at a faster rate than ever before. No more significant chapter in the conservation of a natural resource has ever been written.

Texas Supreme Court to Hear Gas Flaring Case

Authority of the Texas Railroad Commission to shut down oil fields because of flaring gas will face an important test in hearings before the Texas Supreme Court beginning January 12, when the Heyser field case will be considered. The case was appealed by the Texas Attorney General, Price Daniel, to the state's highest court when District Judge Charles O. Betts of Travis County at Austin made permanent a temporary injunction against the Railroad Commission order prohibiting the flaring of gas in the Heyser field, Calhoun County.

Attorneys for the Heyser field operators gained postponement of arguments before the Supreme Court until January 12, although Attorney General Daniel had asked the court to set hearings for December 15. This suit is regarded as a test case, although numerous other similar suits, involving other fields, are now before various Texas district courts, with all such fields currently permitted to continue producing, under injunctions.

In view of steps being taken to effect early elimination of gas waste in the Tijerina-Canales-Blucher field, a Travis County district court at Austin called off a scheduled trial in which operators sought permanent instead of temporary injunction against the Railroad Commission's shutdown order, based on gas waste.

Foster field, Ector County, West Texas, was permitted by the Railroad Commission to continue operating without court action when the commission ordered a 20 percent reduction in oil allowable, which cut gas production to volume that can be disposed of without flaring.

Natural Gas Industry Plans More Heavy Investments

The gas utility industry will spend $3300 million to complete its construction program through 1952, according to the first study of the industry's capital requirements recently made by the American Gas Association. Of this amount, about 80 percent, or $2650 million, will be required by natural gas companies, while only 15 percent, or $500 million, will go to companies marketing manufactured gas. About 40 percent of the total funds will be raised from internal sources, 35 percent through the sale of bonds, 4 percent from the sale of stock, and 21 percent from loans and other sources.

Meanwhile, public financing for natural gas distribution enterprises are figuring prominently in the new issues of interest-bearing securities offered investors. In one day recently, securities totaling nearly $69 million were so offered in New York, including $30 million of 3¼ percent sinking fund debentures by Panhandle Eastern Pipe Line; $26½ million of 6 percent notes by Transcontinental Gas Pipe Line Corporation; and $12 million of first mortgage 3⅜ percent bonds by Georgia Power Company.

The Securities Exchange Comsion recently approved a $66 million Michigan-Wisconsin Pipeline Company bond issue with the Metropolitan and Mutual Life Insurance companies.

The FOREMEN will come to Order

By AL REESE, Managing Editor

THE FOREMEN'S meetings of The Texas Company's Midland district, West Texas division, Producing department, are considered a model unit of a model organization. These meetings are greatly responsible for on-the-job efficiency and are given much credit for high morale and consistently good management-employe relations in the district. This article gives an on-the-scene and behind-the-scenes glimpse of how the meetings are conducted.

DISTRICT warehouseman A. E. Warner wore the expression of a kindly schoolmaster as he concluded his talk and peered through his spectacles at the 26 men before him.

"Questions, fellows?"

Half a dozen hands flew up, questions began crackling about Warner's gray-thatched head, and the foremen of The Texas Company, Producing department's Midland district, West Texas division, were off on one of the spirited discussions which typify this model unit of a highly successful program of industrial relations.

The foremen were jammed so tightly about a U-shaped arrangement of three tables that when hefty H. D. Murray, the district petroleum engineer, got up to speak later on the program, it required considerable exertion on his part and some chair-hitching cooperation from his neighbors to extricate his bulk and clear a path for him.

No unexpectedly large attendance caused this dreath of space, nor was it an omission in planning the meeting. It was a shrewdly deliberate move on the part of T. P. (Red) Drew, the district superintendent, and is an example of the brick-by-brick attention to detail which accounts for the solid foundation of the company's industrial relations program.

This recent session might have been held in the Hotel Scharbauer's spacious banquet room, just down the hall, but to have done so would have removed the elbow-to-elbow intimacy which creates a chatty atmosphere, loosens shy men's tongues, and converts the dread ordeal of speech-making into the not unpleasant chore of "making a little talk before a few of the fellows." The company believes that the loquacity of the average foreman is in inverse ratio to the distance of the farthest listener.

The proof of this pudding was that every single man at the Midland meeting took an active part in the discussion.

It is primarily to maintain this free-and-easy atmosphere that the Midland district foremen meet in two groups on separate days. This practice has the added advantage of enabling someone of responsibility to remain on the job during each of the two meetings.

In keeping with company policy, District Superintendent Drew introduced the speakers and sifted each talk and subsequent discussion for constructive ideas. There his participation ended, again emphasizing Texaco's dictum that these meetings must be of the foremen, by the foremen, and for the foremen.

The rare gaps in the flow of talk were plugged by provoking questions from L. F. Shiplet, a guest of respected opinions and a former Midland district

To avoid gatherings of unwieldly size, foremen of The Texas Company's West Texas district are divided into two groups which meet on separate days. In the above group are T. P. Drew, A. E. Warner, O. L. Stalcup, P. C. Mayfield, W. M. Bumpass, H. D. Murray, W. R. Coleman, L. F. Shiplet, B. O. Smith, R. J. Adcock, L. I. Baker, R. P. Brouthertin, Otto (Jack) Cabaness, W. E. Chapman, Miss Mary Corbin, stenographer; Jack Grigry, C. F. Jackson, B. A. Kelly, M. W. Kennedy, Leonard Kunkel, P. J. Latch, P. T. McGrath, J. R. McLaughlin, J. V. Rogers, E. F. Sparks, T. H. Taylor, H. O. Waters, and R. H. Zuefeldt.

superintendent who, as far as this meeting was concerned, was only incidentally the assistant manager of the West Texas division.

Shiplet's journey of approximately 400 miles from Fort Worth headquarters to sit in with the foremen illustrates another powerful reason for the success of these meetings. The foremen know that what they do and say is watched with keen interest all the way up through the ranks into the realm of the big brass. Either Shiplet, the other assistant manager, J. H. Markley, or the division manager himself, C. B. Williams, usually attends not only the Midland meetings but also similar meetings held in other districts of the West Texas division. Manager Williams takes a special interest in these meetings to see that they are mutually beneficial to both the company and the supervisors who attend.

Another Fort Worth visitor was B. O. Smith, division supervisor of industrial relations who is credited at both Fort Worth and Houston headquarters with much of the success of the industrial relations program in West Texas.

B. O. is a baldish Mr. Five-by-Five who would be the spittin' image of Winston Churchill if that British statesman were 25 years younger, wore a perpetual grin, and talked Texaco from morn till night.

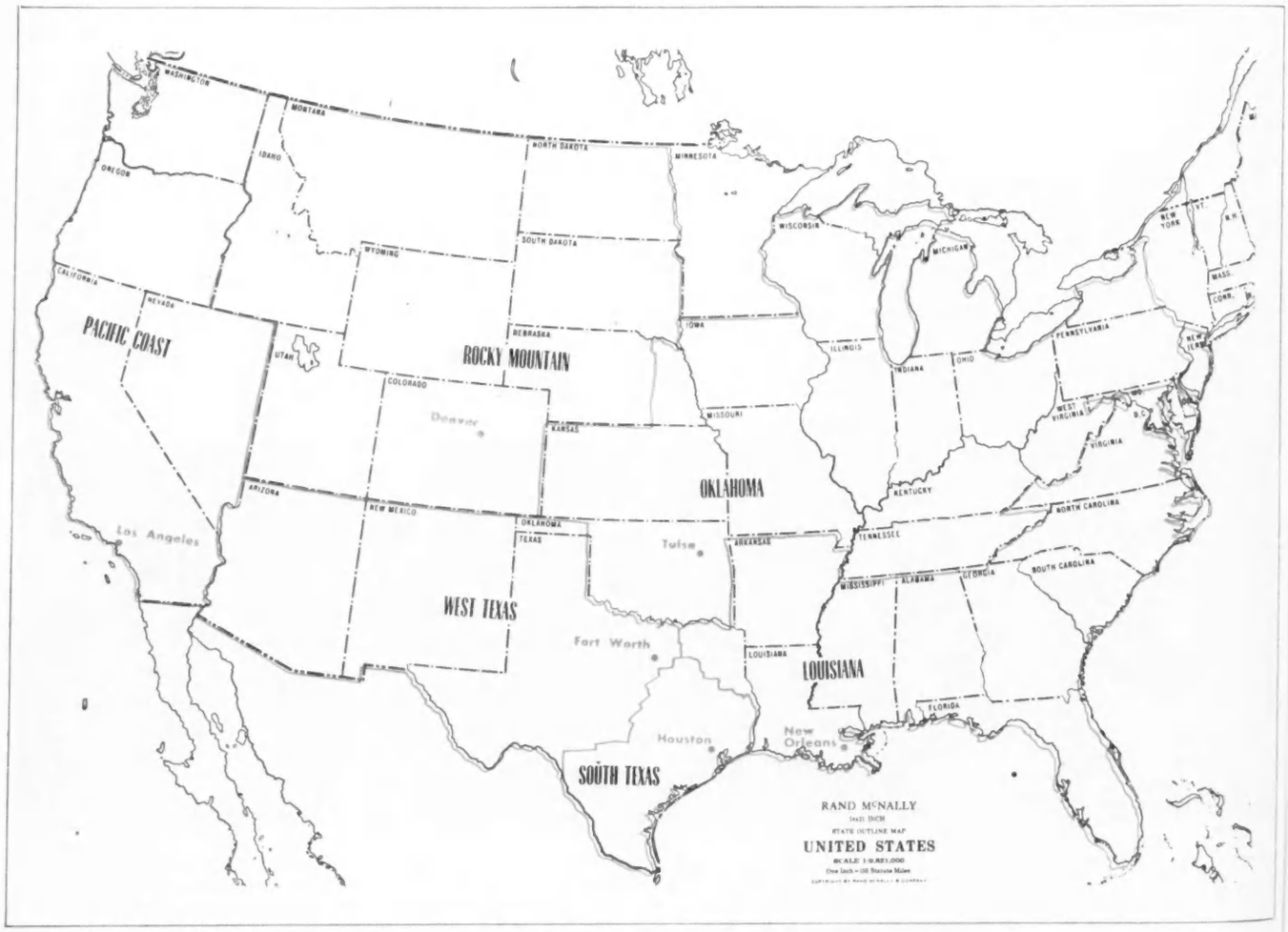
Smith was the industrial relations supervisor in much of West Texas before any such job ever existed. While a company warehouse clerk at Breckenridge 15 years ago, he began attending the informal, irregular foremen's meetings then being held. He saw the need of making a permanent record of the proceedings and began keeping minutes. (Minutes are now kept at all company foremen's meetings, with copies going to everybody present, to the other divisions for an interchange of ideas, to Houston headquarters for study and possible suggestions, and to the New York office.)

When nobody else was willing or able to make a talk, Smith did that, too. Between times, his love for people—especially Texas Company people—made him a pioneer promoter of management-employe relations. As an unofficial envoy of the company, he soothed many an employe who figured he was past due for a raise or promotion. Long before the phrase was coined, Smith was a baby-sitter for Texas Company couples who wanted to take in a movie or a dance.

When the industrial relations program was accelerated to its present tempo in 1944, B. O. made the easy and natural transition from unofficial to official supervisor of industrial relations for the West Texas division.

Smith's other duties, which correspond with those of the other four division supervisors, include direction of safety work, planning supervisors' meetings, and acting as general liaison man for the company in matters involving employes. In the latter capacity he must be abreast of all company policies that concern employes and an expert on company benefit plans and the like. Another duty is to plan the foremen's meetings with the three district superintendents in his division. In the Midland district, an effort is made to strike a healthy balance in the programs by judicious use of operational, inspirational and conference-type subjects.

Drew and his assistants, J. L. Neill and Otto (Jack) Cabaness, arrange for talks on various phases of operations, while Smith arranges for, or himself delivers, the talks on what may be broadly termed company policy. In the latter, most of the division supervisors have the aid of motion picture projectors and slide film projectors. Likewise useful is the wire recorder, which recently transmitted to the foremen a talk by E. R. Filley, manager of the Producing



The divisions and division headquarters of The Texas Company Producing department.

Those taking part on the program, left to right, were H. D. Murray, district petroleum engineer; A. E. Warner, district warehouseman; W. M. Bumpass, district civil engineer; L. F. Shiplet, assistant division manager; T. P. Drew, district superintendent; B. O. Smith, division supervisor of industrial relations; and P. C. Mayfield and O. L. Stalcup of Halliburton Oil Well Cementing Company.

department, on "Foremen's Responsibility for Safety."

This pattern of balanced programs is followed throughout all divisions of Texaco's Producing Department organization. Here are a few programs which were taken at random from the files at Houston headquarters:

Wichita, Kansas, district, Oklahoma division, May 12, 1947: Policy topic—"Case Problems in Supervision." Operational topics—"Bottom Hole Pumps," and "Treating Arbuckle Wells with Formaldehyde."

Alice district, South Texas division, March 28, 1947: Policy topics—"Available Positions in Foreign Operations," "Background and Development of the Group Life Insurance and Pension Plan," "Importance, Cost and Value of the Group Life Insurance and Pension Plan," and "Safety." Operational topics—"Operations in the Southwest Texas district" and "Use and Benefits of the Head Roustabout's Reports."

Craig district, Rocky Mountain division, January 1, 1947: Policy topics—"Management Has Some Problems," "Safety," "Public Relations," "The Ten Commandments for Foremen," and "Case Problems in Supervision." Operational topic—"Depth Pressure Surveys."

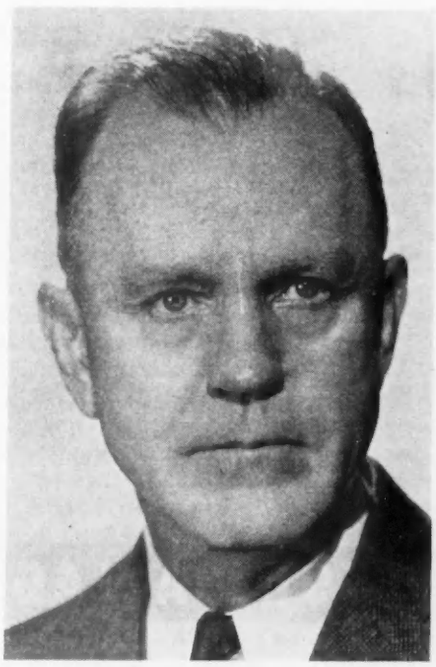
The Midland district's October meeting was held to operational topics in order to restore the balance which had been disrupted by an unusually large number of timely policy talks at previous sessions. Warner's paper was on "Opening, Handling and Closing Estimates." P. C. (Bill) Mayfield and O. L. Stalcup of Halliburton Oil Well Cementing Company presented a paper on "Practical Cementing Methods in West Texas and New Mexico Areas." W. M. Bumpass, the district civil engineer, talked on "Setting Surface Pumping Equipment." Murray's paper was entitled, "Resume of Corrosion Inspection Tour, West Texas-New Mexico, September 14-16, 1948."

These papers and the discussions which followed them consumed three hours—from 2:30 to 5:30 p.m.—and it is a tribute to the papers as well as to the men's interest in their jobs that nobody seemed particularly anxious to adjourn.

Social Side

After a brief intermission, the foremen trooped to the banquet room, where bright lights glittered on snowy linen and polished silver, giving promise of more than the food-for-thought diet previously prevailing.

While waiting for the final preparations for the meal, there was room to mill about, to inquire about "Emma and the kids," to ask P. C. Mayfield some more questions about cementing, and to warm up old friendships with seldom-met fellow foremen who might be stationed 150 miles distant at the opposite end of this sprawling district, one of the largest geographically and the largest land district from the standpoint of activity in the whole Producing department.



C. B. Williams, division manager, West Texas Division, to whom a lion's share of the credit for the success of the foremen's meetings in this division must be given because of his continuing close interest in the program.

When forks had been plunged hilt-deep into the last yielding morsel of succulent steak, and the final bite of pie descended to its destiny, the affair was again taken in charge by Red Drew, adroit master of the art of coaxing other people into speech. The latest jokes went into this brief, mellow night-cap of another successful foremen's meeting.

The format of The Texas Company foremen's conferences is set in a loose framework that recognizes the fact that no two groups are the same and which permits each superintendent considerable latitude in conducting his own meetings. Methods are judged by their success. The success of the Midland meetings may be judged by these significant facts:

(1) Average attendance in 1947 was 90 percent perfect.

(2) Management-employe relationships in both the Midland district and the West Texas division have been consistently good. Morale is high and the division currently enjoys the best safety record in the department.

(3) The organizational needs in this busy area have been met through the advancement of men who were trained on the ground and who, perhaps not entirely by coincidence, have been regular attendants at these meetings.

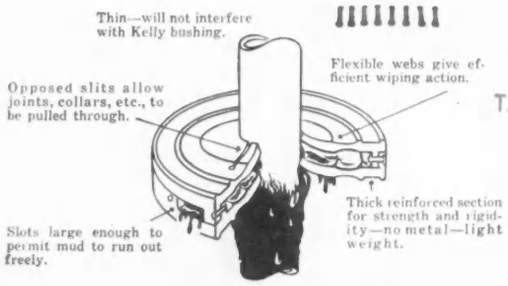
The meetings do not involve any unusual outlay of time or money with the possible exception of the comparatively few men who may travel a considerable distance to attend. Actually, the meeting may be more economical than those in some other companies because of a saving on what L. J. Whetsell, assistant to the manager and in charge of industrial relations, calls "gingerbread." Colorful literature or trick promotional

■ CONTINUED ON PAGE 50

Clean Pipe

WITH THE

TANDEM Pipe Wiper


Thin—will not interfere with Kelly bushing.
Flexible webs give efficient wiping action.
Opposed slits allow joints, collars, etc., to be pulled through.
Thick reinforced section for strength and rigidity—no metal—light weight.
Slots large enough to permit mud to run out freely.

Patterson-Ballagh announces the new, field proven TANDEM Pipe Wiper. Easier to install than two single pipe wipers, this efficient TANDEM will wipe your drill pipe *clean* no matter how *fast* you come out of the hole.

REPLACEABLE HALVES FOR ECONOMY—Identical halves and light hard rubber pins make up the TANDEM. Should either half become worn, only that half need be replaced. Each replacement half supplied with new pins. Halves easily assembled into rigid unit.

TANDEM WIPER FOR EFFICIENCY—Any mud the lower wiper misses, the upper wiper is sure to get. Wipers are spaced far enough apart to prevent mud caking, yet close enough so there is no interference with Kelly bushing.

For top pipe wiper performance, use the new Patterson-Ballagh TANDEM on your rig. For more information, write for Bulletin No. 2-48.

Specify

PATTERSON-BALLAGH

DIVISION OF BYRON JACKSON CO.

TANDEM PIPE WIPERS

PATTERSON BALLAGH · SEAL OF QUALITY · OIL FIELD SPECIALTIES

MAIN OFFICE: 1900 EAST 65TH STREET, LOS ANGELES 1, CALIFORNIA

6247 Navigation Blvd., Houston 11, Texas • 808 Graybar Bldg., New York 17, N.Y. • 330 Russ Bldg., San Francisco 4, Calif.
T.I.P.S.A. Santiago Del Estero 286, Buenos Aires, Argentina • H. F. Towler, 9 Cavendish Square, London W1, England.

Unitization of Areas Involving U. S. Lands

By JOHN R. MORAN, Attorney, Denver, Colo.

SINCE the approval by the Secretary of the Interior of the first unit agreement which related to the Little Buffalo Basin area of Wyoming on January 6, 1931, approximately 275 unit agreements, of which 214 are in the Rocky Mountain region, have received the approval of the secretary.

The approved and active agreements include one covering a portion of the important Salt Creek field of Wyoming, comprising approximately 15,338 acres. This multiple sand field, although discovered in 1908 and almost completely developed by the early 1920's, was not unitized until 1939. The Elk Basin field, in the northern part of Wyoming and the southern part of Montana, is unitized as to certain producing formations underlying 17,784 acres. This area, although proved productive in 1915, was not unitized until May 1, 1946, after the discovery of deeper production in 1942. Of the total unit area, 5877 acres are now within the Tensleep participating area. Both fields are operated by Stanolind Oil and Gas Company.

The Church Buttes field of southwestern Wyoming, controlled by Mountain Fuel Supply Company and Union Pacific Railroad Company, consisting of 49,838 acres, was committed to a unit agreement approved August 17, 1944. The Vernal unit of The Carter Oil Company in the Uintah Basin of Utah comprises about 57,000 acres. The Bowdoin Dome unit area embraces 148,094 acres in the north central part of Montana. The Cedar Creek units of southeastern Montana include a total of 114,315 acres.

The above are only a few of the larger areas but unit agreements have been approved on areas as small as 700 acres. Other major producing areas in the Rocky Mountain region being operated under unit agreements include Wilson Creek in Moffat and Rio Blanco counties, Colorado; Lance Creek in Niobrara County, Wyoming; Gebo in Hot Springs County, Wyoming; Oregon Basin in Park County, Wyoming; and many other large producing fields. The Rangely field of northwestern Colorado is not unitized but efforts along that line are now in progress.

Wildcat areas and producing areas have been committed to unit agreements with like effect until, in all, there are approximately 2½ million acres of land being developed for oil and gas under the terms of unit agreements having the approval of the Secretary of the Interior. Of this total, nearly 1,855,000 acres are in the Rocky Mountain area, excluding New Mexico.

In some cases, such as Salt Creek and Elk Basin, several years of effort were required to complete the unit agreements. Some of the interested companies assigned full-time staffs to working out the problems as they arose. In some cases, unit agreements have been completed in a comparatively short time, particularly where all of the operating rights in the leases sought to be unitized were owned by a single operating company or individual.

In the unitization procedure, there does not seem to be any insurmountable problem. The procedure has been carefully outlined and kept up to date through departmental regulations applied and interpreted by officials who are familiar with the technical engineering problems as well as the legal and practical problems. The cooperative spirit of the personnel of the Geological Survey and other branches of the Department of the Interior is demonstrated by the number of agreements of varying complications which have been approved since they were first authorized. State officials also have been most cooperative.

Individual landowners seem to present the greatest problem in securing complete and effective unitization of an area embracing lands of the U. S. and lands which have been patented without mineral reservations. Proper presentation of engineering data and geological data in support of a request for an individual landowner to become a party to a unit agreement, in most cases, is persuasive. The benefits to be derived from unitization, if properly presented to the landowner, most generally outweigh the objections raised by such individual. If the process of unitizing an area were more often assigned to individuals thoroughly informed of the geological data relating to the area sought to be unitized and of the practical results to be derived from unitization, individual objections would be more readily overcome.

Unitization of lands and interests therein for oil and gas development and operation has passed the experimental stage and should now be considered a standard type of operation. There are many forms which are referred to as unitization agreements and many variations in so-called unitized operations. Complete unit agreements, however, contemplate the pooling of all rights and interests in a given area so that such area may be developed and operated as though it constituted a single oil and gas leasehold estate without regard to property lines or differences in interests in the several tracts comprising the area.

Unitization of areas, which included lands of the U. S., was first authorized in an act of Congress, approved July 3, 1930 (46 Stat. 1007), amending Sections 17 and 27 of the Act of February 25, 1920 (41 Stat. 437), generally referred to

as "the Mineral Leasing Act." The original amendment expired by its own limitation on January 31, 1931. Further amendments, however, have been adopted and the unitization provisions of the Mineral Leasing Act as of the present time appear in the statutes at 41 Stat. 437 (30 U.S.C.A. 181 et seq.) as amended by the Act of August 8, 1946 (60 Stat. 946).

The first step in the formulation of a unit area is the filing of an application for the designation of an area logically subject to development under a unit or cooperative agreement in the office of the U. S. Geological Survey having jurisdiction of the area involved. The application is required to be accompanied by a map or diagram outlining the area to be affected. The federal, state and privately owned lands are required to be indicated by distinctive symbols or colors. Lands subject to oil and gas leases from the U. S. are to be identified by their lease serial numbers. Geologic information, including the results of any geophysical surveys, and other available information showing that unitization is necessary and advisable in the public interest is also required. All geologic information submitted with such an application, upon request, is treated as confidential. The application must also indicate the depth of the test which will be drilled if the area is approved for unitization. If the area and the depth of the test are not accepted by the director, modifications are generally suggested.

The request for the designation of a unit area may be limited to a specific formation or to certain formations or to all oil and gas deposits. Unitization of all formations is the general practice.

In the event the area is approved by the director of the Geological Survey as an area logically subject to development under a unit agreement, the next step is the preparation of a proposed form of agreement to be submitted for preliminary consideration and such revision as may be deemed necessary by the director of the Geological Survey in advance of its execution by the interested parties. A suggested form of unit agreement acceptable for use in the unitization of unproven areas is set forth in the regulations. While the use of the form is not mandatory, any substantial departure must be submitted for preliminary consideration and unless the change is supported by a good and sufficient reason, it will not be approved. On the other hand, if a discovery of oil or gas has been made upon the area prior to unitization, the form set forth in the regulations must be modified to meet whatever problems are presented by reason of the discovery.

The owners of all rights and interests in the oil and gas deposits to be unitized under the provisions of an approved unitization agreement are regarded as proper parties to such agreement. The regulations require that all such parties be invited to become parties to the agreement. If any party fails or refuses to join, the proponent of the agreement is required to submit evidence that a reasonable effort was made to obtain the joinder of such party and the reasons for non-joinder must be submitted. When the agreement has been executed by all parties who are willing to join therein, a minimum of six signed counterparts of the agreement are required to be filed in the office of the oil and gas supervisor for the region in which the unit area is situated. Upon final approval, one approved counterpart will be returned by the approving official to the operator designated in the agreement.

Unit Operators

The standard form of unit agreement contemplates the designation of one owner of a working interest in the unit area as unit operator to conduct all development and operations upon the unit area on behalf of all of the owners of operating rights in lands included therein. The unit operator must be able to qualify under the Mineral Leasing Act as being entitled to hold interests in lands of the U. S. and must execute an acceptance of the duties and obligations imposed upon the unit operator by the terms of the unit agreement. The designation of, or a change in, a unit operator is subject to the aproval of the Secretary of the Interior or the director of the Geological Survey and approval of a unit operator will not be granted unless the approving official considers the designated party as qualified to fulfill the duties and obligations imposed upon the unit operator by the provisions of the unit agreement.

Laws have been adopted in the majority of states in which public lands are located authorizing state owned lands to be included within the provisions of unit agreements, when such agreements are duly approved by the designated state official. The departmental regulations require agreements embracing lands belonging to a state to be approved by the appropriate state official prior to the date the agreement is submitted to the Department for its approval.

In areas embracing lands in which the operating rights are owned by different persons or corporations, and as a preliminary step to the formation of a unit, it is desirable that the owners of such operating rights first agree among themselves as to which one should act as unit operator, in the event the unit agreement is completed. They should also agree upon a basis for sharing the cost and expense of unitization, development and operations to be conducted upon the unit area and upon a proper division of the benefits accruing therefrom. The departmental form of unit agreement contemplates that such an accounting agreement will be entered into by the owners of the working interests or operating rights and requires that three copies of such agreement be filed with the supervisor of the Geological Survey. Such agreements may not alter or modify the terms and provisions of the unit agreement or relieve the unit operator of any right or obligation established by the unit agreement. In the event of any conflict between the unit agreement and the accounting agreement between the working interest owners, the unit agreement must control.

The departmental form of unit agreement contemplates and provides for the drilling of a test well to a specified depth upon the unitized land. If such well is completed as a producing well, a plan of further development is required to be submitted for the approval of the Supervisor and when submitted and approved, constitutes the further drilling and operating obligations of the unit operator under the agreement. In any plan so submitted, the unit operator is required to specify the number and locations of other wells to be drilled, the time for such drilling and, to the extent practicable, specify the operating practices regarded by the unit operator as necessary and advisable for proper conservation of the natural resources. Separate plans may be submitted for separate productive zones, if approved by the supervisor. Any plan so submitted may be modified or supplemented, when necessary, to meet changed conditions or to protect the interests of the parties to the agreement.

If a well capable of producing unitized substances in paying quantities is completed upon the unit area, the unit operator is required to submit, for the approval of the director, a description of that part of the unitized area which is then regarded as reasonably proved to be productive. If the director concurs in the opinion of the unit operator, the area considered productive is then designated as the participating area. All production is then allocated on an acreage basis, or some other equitable basis, as may be provided in the unit agreement, to the lands comprising the participating area. The parties to the agreement owning interests in the lands comprising the participating area share in the production allocated to their respective interests as though the production so allocated was produced from the tract in which they own a particular interest. Provision is made for enlargement of the participating area if development

proves additional lands within the unit area to be productive. If the participating area is enlarged, owners of interests in the lands added to the participating area thereafter participate in the production, on the allocation basis, as in the first instance.

Ample provision is made in the unit agreement for exploration and development upon lands within the unit area which may not be within a participating area, thus permitting any working interest owners to attempt to prove the productivity of lands contributed to the unit by them. If such lands are proved productive, provision is made for including such lands within the participating area or within a newly created participating area embracing such lands as may be proved by such outside development.

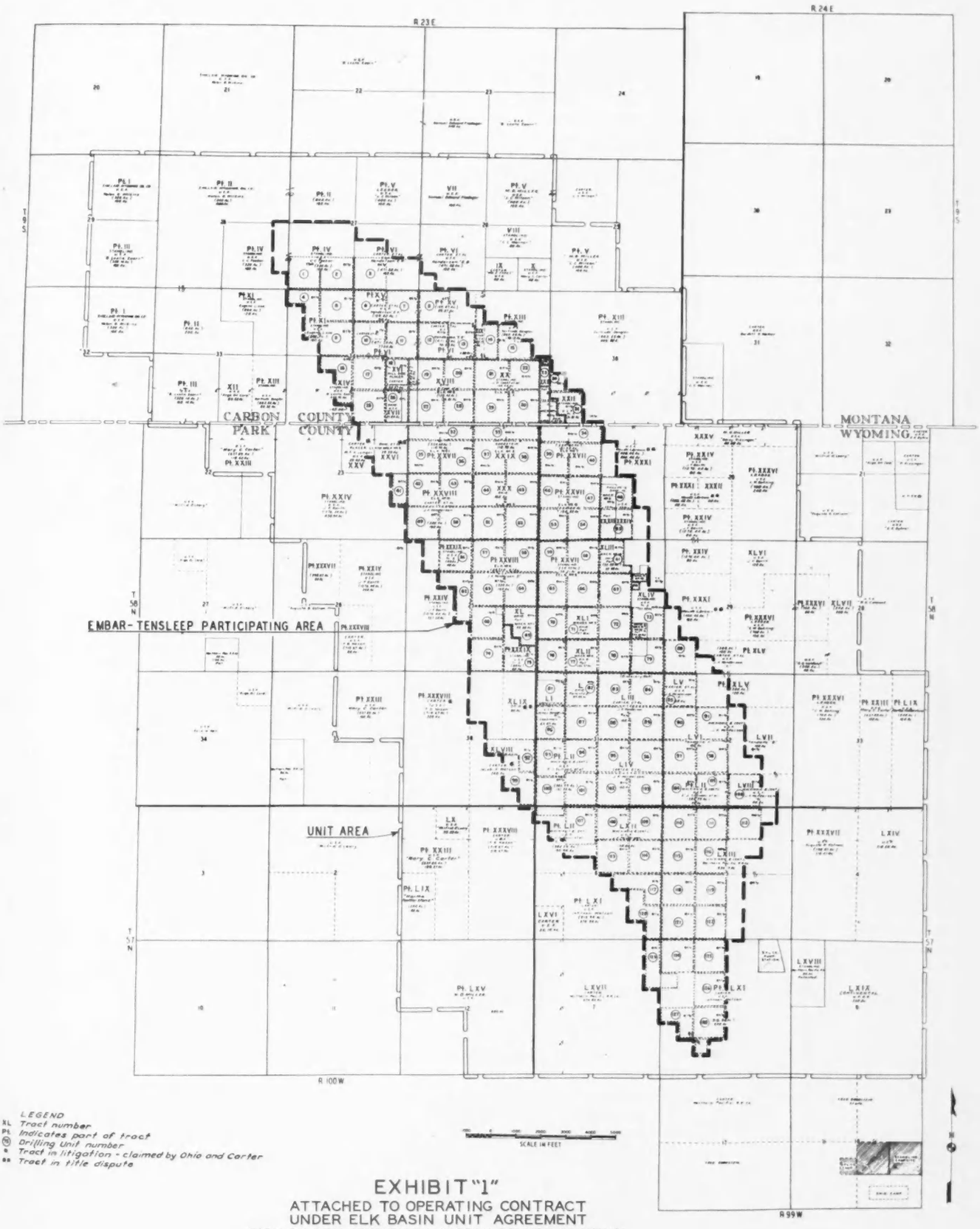


EXHIBIT "1"
ATTACHED TO OPERATING CONTRACT
UNDER ELK BASIN UNIT AGREEMENT
PARK COUNTY, WYOMING & CARBON COUNTY, MONTANA

Unit areas and participating areas may be expanded or contracted of development warrants. The participating area, however, may not be contracted to exclude lands on account of depletion of unitized substances but may be contracted to exclude land when it is reasonably proved that such land will be nonproductive.

Operations under an approved unit agreement and production of unitized substances therefrom are required to be conducted to provide for the most economical and efficient recovery in order that the maximum efficient yield may be obtained without waste, as defined by applicable state of federal laws or regulations.

Unit areas must be protected from drainage by wells not on land subject to the unit agreement. In lieu of offset drilling, the agreement permits the payment of compensatory royalty upon a basis to be determined by the Supervisor.

All leases and contracts affecting committed lands embraced within an approved unit area, by the provisions of the unit agreement, are specifically amended and modified to conform the requirements thereof to the provisions of the agreement. Drilling and producing operations upon the unit area are considered as compliance with all drilling and producing operations required by the terms of the leases and other agreements affecting the lands within the area. The primary terms of all federal leases committed to the unit are extended, so long as they remain committed, provided a discovery is made prior to the expiration of the primary term. All other leases are automatically extended during the life of the agreement.

Most agreements specify that they are to continue in force and effect for a term of five years from date of approval, and as long thereafter as unitized substances can be produced in paying quantities, with certain provisions permitting the earlier termination of the agreement under conditions specified. The agreement may provide for termination at any time by not less than 75 per centum, on an acreage basis, of the owners of working interests committed to the agreement, subject, however, to the approval of the director.

The rate of prospecting, development and production upon unitized areas is subject to federal or state statutes relating thereto and to the jurisdiction of such regulatory bodies as may be created thereunder. The director is specifically authorized to alter or modify, in his discretion, the rate of prospecting and development and the quantity and rate of production under the agreement, limited, however, by public interest. In any order relating thereto, the director is required to state the "public interest" to be served.

The suggested form of agreement contains miscellaneous provisions covering force majeure, fair employment and loss of title.

When the agreement has been formally executed by all parties in interest and submitted for the approval of the director, the director certifies that the unit plan of development and operation is necessary and advisable in the public interest, and is for the purpose of more properly preserving the natural resources of the unit area, and determines that the obligations of all federal leases committed thereto are altered, changed or revoked to conform to the specific provisions of the agreement.

Much Federal Land

By the specific provisions of the Mineral Leasing Act, no individual, association or corporation may hold or control, either directly or indirectly, more than 15,360 acres of federal lands in any one state. Federal acreage committed to approved unit agreements is, however, non-chargeable against such limitation. This feature of the Mineral Leasing Act has undoubtedly caused many units to be formed in advance of development in order that the interested working interest owners may proceed with the acquisition of additional prospective areas. Considering that in the Rocky Mountain Area more than one-half of the oil and gas rights under all lands are retained by the U. S., there is little, if any, possibility of a productive area being found which does not embrace lands in which the U. S. has some interest. The matter of unitization is, therefore, one of prime concern in the future development of the vast unexplored areas in the region.

In justice to the federal government, it should be stated that its huge interest in such a tremendous area does not constitute a serious drain on the natural resources of the several states. Funds accruing to the U. S. from oil and gas operations upon public lands are allocated back to the source states for various public purposes as follows: 52½ percent is reserved and appropriated for reclamation purposes in the state; 37½ of such funds are paid direct to the state, to be used by it, or its subdivisions, for the construction and maintenance of public roads, the support of public schools, or other public educational institutions, as the legislature of the state may direct. Only 10 percent of the money received from sales, bonuses, royalties and rents under the provisions of the Mineral Leasing Act, except those from Alaska, are retained by the U. S.

According to the annual report of the director of the Geological Survey to the Secretary of the Interior for the fiscal year ending June 30, 1947, 53 percent of all petroleum, 62 percent of all gas and 74 percent of all gasoline and butane produced from public lands of the U. S., during that year, were produced from lands committed to approved unit plans.

The mineral Leasing Act makes provision for the approval of co-operative plans of development in addition to unit agreements. No prescribed form of cooperative agreement has been issued by the department. Such an agreement is defined as a plan of development and operation for the recovery of oil, gas, natural gasoline and associated fluid hydrocarbons made subject thereto, in which separately owned units are independently operated either with or without allocation of production. While several such agreements have been approved by the department, special circumstances would have to be shown to justify adoption of such an agreement in preference to the standard unit agreement.

Some attorneys have expressed their apprehension of unit agreements on the ground that they may be considered as violating the anti-trust laws. Other lawyers and legal departments of major companies, having made a thorough study of the question, are firmly of the opinion that the agreements are not violative of such statutes. The American Institute of Mining and Metallurgical Engineers, Inc., has sponsored the publication of a volume, "Anti-Trust Laws et al., vs. Unit Operation of Oil or Gas Pools," which is, as yet, unavailable. This publication will, undoubtedly, add valuable material to the field of unitization and should be of interest to all readers when it becomes available.

In the preparation of this article, an effort has been made to make it brief and it is not to be considered as an exhaustive treatise on the subject of unitization or the many varieties of unitized operations. The economic and technical angles of unitization have been avoided in their entirety. These fields, necessarily, should receive the consideration of the geological, engineering and production personnel.

ACKNOWLEDGEMENTS

The cooperation of the personnel of the Conservation Branch of the United States Geological Survey for furnishing source material for some of the statistics of this article is gratefully acknowledged.

REFERENCES

Mineral Leasing Act, as amended; 30 U.S.C.A. and Sup. Sections 181 et seq.; Code of Federal Regulations of the United States, as amended; Title 30—Mineral Resources, Chapter 2—Geological Survey, Department of the Interior, Part 226—Unit or Cooperative Agreements; Annual Report of the Director of the Geological Survey to the Secretary of the Interior for the Fiscal Year Ending June 30, 1947.

Driller's Choice

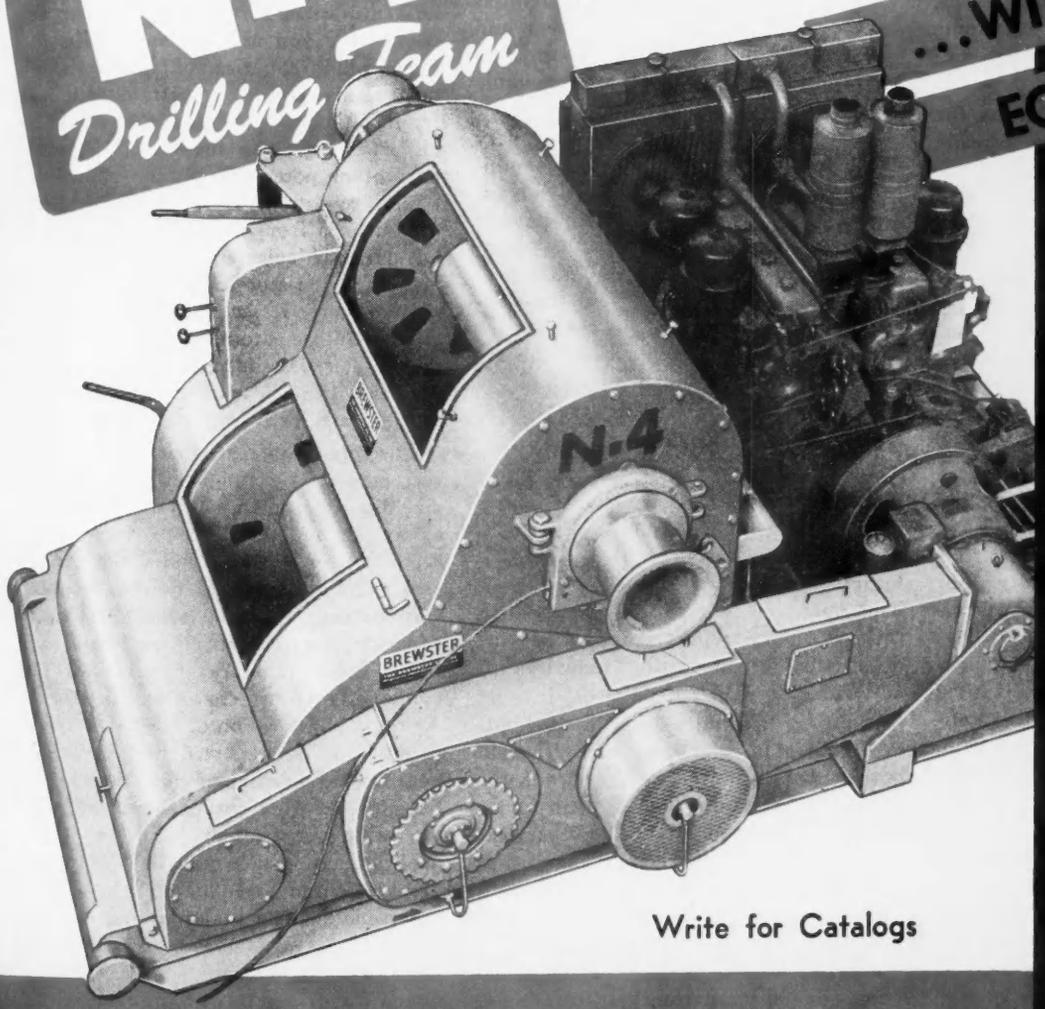
FOR ECONOMY AND EASE OF OPERATION IN DRILLING 4500'-5500'

BREWSTER N-4 Drilling Team

FEATURING THE N-4 DRAWWORKS

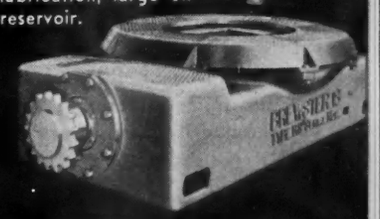
A lot of power has been packed in this easily portable rig. The Torque Converter gives it the flexibility of steam. Air Controls lend speed and safety. The hydromatic brake adds efficiency. Available in either single or double drum models with any popular power unit.

...WITH MATCHED EQUIPMENT



H-100 HOOK BLOCK
Perfectly balanced for straight fall. No dangerous projections. Double row tapered roller bearings on each of the three sheaves. 100 ton capacity.

4-S OILBATH SWIVEL
Streamlined for safety, with the minimum number of parts. Bearing capacity of 120 tons. Oilbath lubrication, large oil reservoir.



RS-18 OILBATH ROTARY
A heavy duty High Speed box-type rotary with a full 18" table opening. Compact integral cast bed and skid. Heat treated spiral bevel gears. Slush-proof table. Rated dead load capacity 167 tons.

Write for Catalogs

Sold by:
APEX EQUIPMENT CO.
BOYAIRD SUPPLY CO.
INDUSTRIAL SUPPLY CO.
MURRAY BROOKS, INC.
REAMS SUPPLY CO.

In Canada:
HALEY SUPPLY CO.

Export Sales:
BAIRD SUPPLY CO.
420 Lexington Ave., New York 17, N. Y.

The BREWSTER CO., Inc.
Manufacturers of Drilling Equipment
Since 1910
SHREVEPORT, LOUISIANA, U.S.A.

BREWSTER
Drilling Equipment

Dispersion of Facilities Sought for National Security

THE petroleum industry is cautioned, along with other industries, that dispersion of its facilities and its workers is desirable, in the interest of the oil companies and their employes as well as in the interest of the national security. This decentralization probably should be initiated, it is suggested by the National Security Resources Board, as new facilities are built and as obsolescent facilities are replaced. Although relocation of existing facilities may not be economically feasible in many cases, it is conceded, the moving of some highly vulnerable plants should be considered.

In several of its major divisions the petroleum industry's facilities already are widely dispersed, including exploration, production, transportation, and distribution. Oil wells, buried pipe lines, tank cars, tank trucks, and other facilities in these branches of the industry are scattered and not choice military targets, though there may be exceptions. Oil tankers are targets of submarines, particularly, and the U. S. is promoting greater speed as a principal defense for new tankers.

It is primarily in connection with refineries, terminals, and tank farms that there is danger of military attack on petroleum industry facilities. But this makes a great enough difficulty. For instead of decentralizing refining facilities, the industry in recent years has been finding it economically advantageous to achieve greater centralization. Since the war this trend toward centralization of refining has been quite pronounced, having been accentuated by construction of new products pipe lines. These products lines permit serving larger areas from large efficient refineries, instead of operating scattered smaller refineries to serve the different localities. Larger refineries as a rule can achieve lower costs of products than smaller plants by handling greater volume with a given unit of equipment.

Another reason for centralization of refineries has been the economic desirability of locating plants on tidewater in order to market products by tanker or barge. It has been found economically desirable, furthermore, to choose these tidewater refinery sites mostly within limited areas, such as the populous New York, Philadelphia, Chicago, and Los Angeles consuming areas and the shipping outlets for large oil producing districts such as the Houston, Beaumont-Port Arthur, and Los Angeles areas. Large tank farms, oil terminals, synthetic rubber plants, and toluol plants necessarily are located close to the large refineries.

All these arrangements of facilities have evolved as the most efficient and low-cost set-ups, achieving the greatest advantages possible from the economic or business standpoint.

To change all this would be a very great problem, physically and economically. Important economies and advantages apparently would have to be sacrificed in order to get protection from military attack. Nevertheless, this protection should be sought, says the government planning board, in the interest of the owners and employes of the refineries as well as in the interest of the national security.

Likely Targets

Facilities of the petroleum industry are mentioned specifically by the National Security Resources Board as likely targets of the enemy in event of war. This mention is made in the board's recently issued report pointing out the desirability of dispersing industry for national security reasons.

The report includes a list of the kinds of facilities in which an enemy would be particularly interested. One of the categories mentioned was "All major developments, industrial or otherwise, which could be considered highly inflammable or explosive to the extent that their general destruction would substantially endanger other vital resources in the area. This would include such things as oil refineries, oil storage facilities, paint and chemical plants." In this classification are many facilities of the petroleum industry.

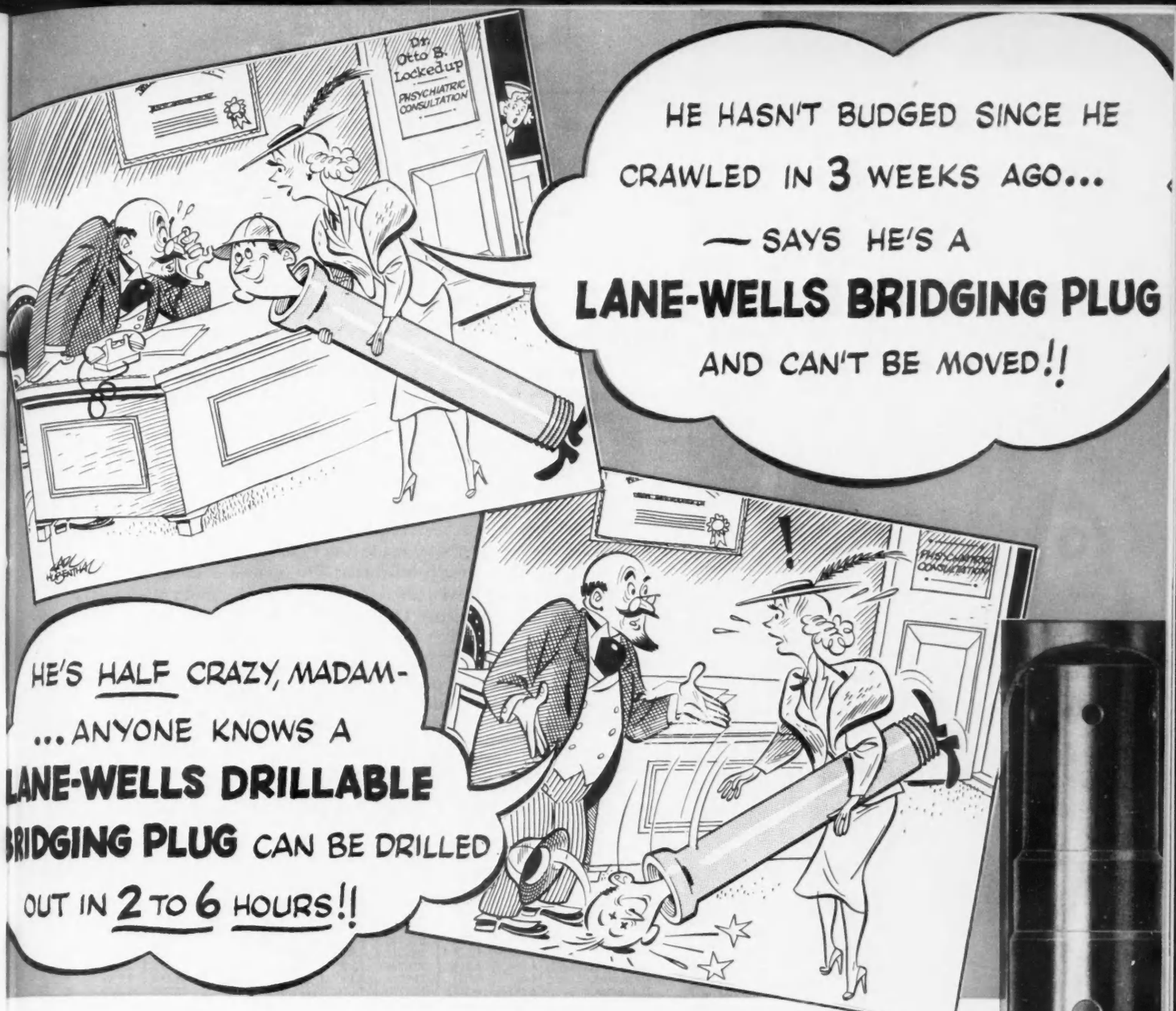
Another type of facility mentioned by the board is "An individual plant, producing a large percentage of a highly critical item, which if destroyed, would have immediate far-reaching adverse effects on the production of that and other related items." In this group, though not mentioned by the board, might be certain synthetic rubber, toluol, aviation gasoline, and other plants having vital roles in war production.

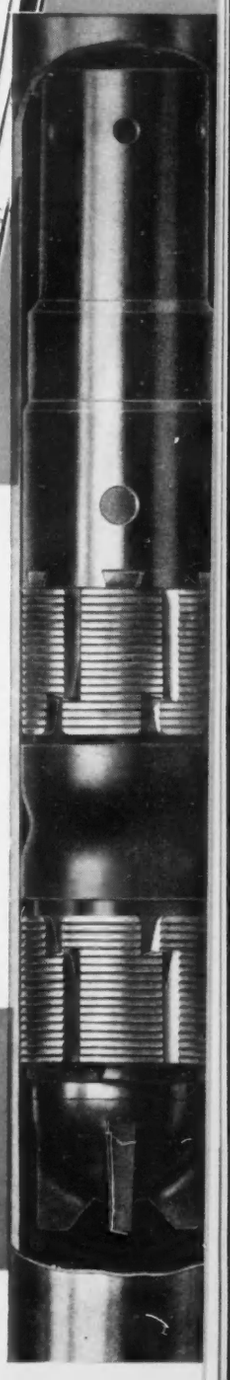
"It may be," pointed out the board, "that your facilities are not the particular target the enemy is seeking, but if there are others in the area that he has earmarked for destruction, the net results for you are the same." In the case of oil refineries, oil terminals, oil tank farms, and other petroleum industry facilities, this consideration would be important, because they are frequently near other potential military objectives.

The report takes into consideration the hazards from conventional bombing but puts particular emphasis on the hazards from the atomic bomb in the hands of an enemy. It states that in the foreseeable future, atomic bombs, made of rare materials and at great cost, will never be dropped without expectation of much strategically important destruction.

The report suggests that efforts be directed to the development of a progressive dispersion plan, built around normal expansion and obsolescence factors. As regards new facilities, industrial expansion should avoid further urban concentrations of over 50,000 people and plant concentrations covering over five square miles, since larger concentrations become potential targets for atomic bombs. As regards relocation of already existing facilities, it is suggested that their vulnerability be assessed by drawing a three-mile radius circle about the periphery of the present facilities. These facilities naturally would be highly vulnerable if the three-mile circle around them contained a major military objective, such as a shipyard, aircraft plant, large aluminum plant, or other plant highly important to war production.

In planning for the development of a dispersion plan for an industry, said the report, an attempt should be made to disperse not only a maximum number of its manufacturing installations but also the manufacture of individual products.


Dr. Otto B. Lockedup
PSYCHIATRIC CONSULTATION
HE HASN'T BUDGED SINCE HE CRAWLED IN 3 WEEKS AGO...
— SAYS HE'S A
LANE-WELLS BRIDGING PLUG
AND CAN'T BE MOVED!!
HE'S HALF CRAZY, MADAM-
...ANYONE KNOWS A
LANE-WELLS DRILLABLE
BRIDGING PLUG CAN BE DRILLED
OUT IN 2 TO 6 HOURS!!



Everyone knows there are only two really important features about bridging plugs. First: That they set and hold where they are placed. Second: That they can be quickly and easily drilled if desired.

Lane-Wells Drillable Bridging Plugs give you both these advantages. Operators in almost every producing field in the world have proved that these superior Bridging Plugs provide a quick, economical bridge for either temporary or permanent location because they give positive, leakproof pack-off.

Yet they can be drilled out or knocked down in a minimum of time. Usually a single rock bit is sufficient to do the job with rotary tools; ordinary tools do the same quick job with a cable tool rig.

When you want a bridge—choose a Lane-Wells Bridging Plug—and be time and money ahead.

Send for your copy of the NEW Lane-Wells Bridging Plug Bulletin!

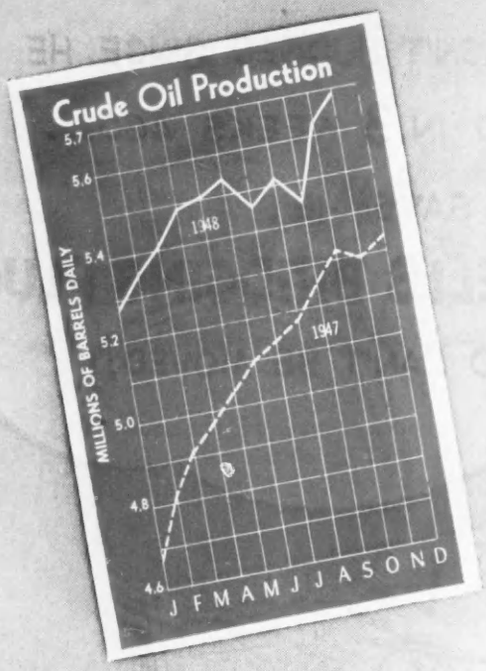
LANE WELLS COMPANY

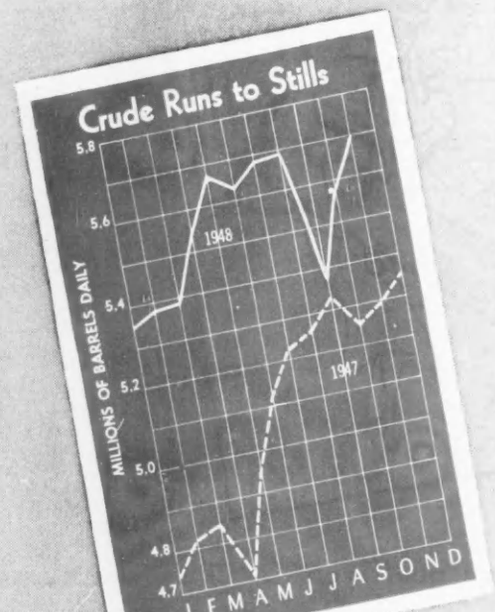
TECHNICAL OILFIELD SERVICES

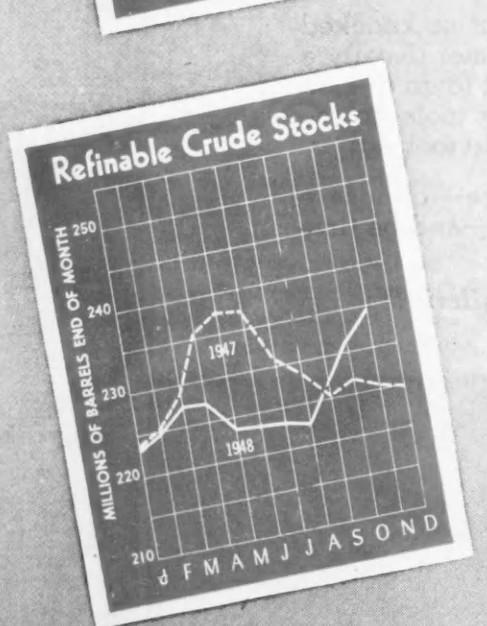
LOS ANGELES • HOUSTON • OKLAHOMA CITY

General Offices, Export Offices and Plant
5610 S. Soto St., Los Angeles 11, Calif.

24 HOUR SERVICE • 49 BRANCHES







Petroleum

Record Output Increases

By CECIL SMITH,

TWO all-time records were broken in November when the industry's producers and refiners pushed their operations to points considerably higher than in any other period. As a result of the extremely high production rate, domestic production was almost enough to supply refinery requirements, thereby allowing most of the difference between crude imports and exports to be sent to stocks. This situation made it possible for refinable crude oil stocks to rise to their highest point since the middle of last year.

Increased output of the principal refined products, resulting from the record-high refinery runs, made substantial gains in product stocks possible. Gasoline inventories got a good start in their seasonal build-up and the fuel oils continued to rise. Heavy output of the fuel oils along with the mildness of the weather has made this year a little unusual, for in the past, fuel stocks had already started their downward trend by the end of November, while this year that time found them at about their peaks.

Crude oil production from U. S. fields averaged 5,680,000 barrels daily

Crude Oil and Refined Products Trends
(THOUSANDS OF BARRELS)

	CRUDE OIL			GASOLINE		DISTILLATE FUEL		RESIDUAL FUEL	
MONTH	Production Daily	Runs to Stills Daily	Stocks End of Month	Production Daily	Stocks End of Month	Production Daily	Stocks End of Month	Production Daily	Stocks End of Month
1945:									
January	4,756	4,680	221,737	2,094	91,666	663	31,695	1,350	44,347
February	4,767	4,817	220,221	2,194	97,457	724	27,210	1,326	39,760
March	4,804	4,719	223,988	2,124	97,447	675	26,729	1,273	35,451
April	4,807	4,774	224,229	2,127	90,804	681	29,148	1,289	34,418
May	4,887	4,913	223,151	2,179	88,530	708	29,511	1,341	34,333
June	4,859	4,989	218,218	2,166	86,128	730	32,440	1,351	35,606
July	4,897	5,001	216,638	2,281	85,582	713	36,276	1,351	38,341
August	4,870	4,928	215,135	2,269	84,003	701	41,245	1,329	42,227
September	4,423	4,275	220,319	1,933	74,574	640	45,059	1,139	42,822
October	4,284	4,244	221,246	1,888	76,805	613	45,479	1,176	42,008
November	4,517	4,624	218,916	2,156	86,540	665	44,562	1,265	41,322
December	4,472	4,574	218,763	2,056	97,676	683	35,778	1,245	37,158
1946:									
January	4,625	4,520	223,442	1,914	102,394	787	28,990	1,224	34,573
February	4,719	4,651	227,220	1,884	104,836	823	25,511	1,243	34,008
March	4,414	4,661	221,400	1,900	104,161	815	29,922	1,213	32,995
April	4,673	4,663	222,480	1,943	98,744	773	32,064	1,247	35,206
May	4,785	4,794	221,592	2,016	93,960	753	33,385	1,220	38,932
June	4,896	4,836	223,140	2,055	91,971	777	38,824	1,219	41,492
July	4,922	4,856	224,351	2,102	87,778	793	46,439	1,163	45,446
August	4,836	4,856	224,157	2,189	86,745	765	54,068	1,159	48,186
September	4,790	4,839	222,417	2,143	87,021	796	62,019	1,150	54,012
October	4,785	4,736	222,177	2,117	85,952	788	76,780	1,090	55,580
November	4,823	4,684	226,453	2,162	88,587	791	68,145	1,101	52,735
December	4,725	4,789	224,473	2,168	92,742	805	59,912	1,159	47,094
1947:									
January	4,671	4,739	223,848	2,078	99,623	778	48,197	1,174	41,550
February	4,810	4,820	225,121	2,089	103,672	777	36,901	1,228	48,480
March	4,908	4,843	228,981	2,076	105,679	825	31,423	1,222	37,403
April	4,974	4,707	235,710	2,037	101,724	764	30,268	1,148	36,455
May	5,033	4,947	237,768	2,128	95,209	805	34,279	1,204	39,992
June	5,099	5,120	237,278	2,258	89,774	807	39,676	1,233	43,515
July	5,137	5,221	230,974	2,302	86,003	847	46,444	1,244	47,600
August	5,173	5,260	228,523	2,383	85,849	869	54,707	1,245	51,334
September	5,251	5,236	225,258	2,375	84,360	911	59,764	1,237	52,578
October	5,320	5,253	226,666	2,371	82,584	938	63,252	1,260	52,502
November	5,291	5,291	225,462	2,332	87,551	942	61,334	1,245	52,455
December	5,337	5,350	224,929	2,347	92,303	992	51,081	1,282	47,091
1948:									
January	5,283	5,348	223,430	2,328	102,167	1,082	41,036	1,278	44,636
February	5,353	5,380	224,880	2,264	110,999	1,127	34,590	1,295	43,156
March	5,406	5,387	227,408	2,252	111,949	1,050	32,214	1,307	41,945
April	5,484	5,540	227,278	2,396	109,829	978	34,514	1,303	43,301
May	5,502	5,668	223,820	2,486	108,552	992	40,781	1,314	48,518
June	5,544	5,632	223,481	2,529	104,518	998	48 352	1,280	52,465
July	5,522	5,631	223,124	2,494	98,839	994	58,725	1,264	58,431
August	5,577	5,621	224,211	2,532	95,445	1,038	68,818	1,248	64,096
September	5,435	5,376	228,401	2,416	90,518	961	76,320	1,154	68,005
October	5,621	5,581	231,006	2,474	91,847	1,062	81,815	1,287	72,214
November	5,680	5,682	234,305	2,516	94,416	1,077	84,655	1,300	76,579
November, 1948: Changes:									
In Month	+59	+101	+3,299	+42	+2,569	+15	+2,840	+13	+4,365
In One Year	+389	+391	+8,843	+184	+6,865	+135	+23,321	+55	+24,124
In Two Years	+857	+998	+7,852	+354	+5,829	+286	+16,510	+199	+23,844

Trends

Crude and Product Stocks

Staff Writer

during November to reach a new all-time peak. That was an increase of 59,000 barrels a day over October's 5,621,000 barrels that had been the record level. November's crude output also topped that of a year ago by 389,000 daily.

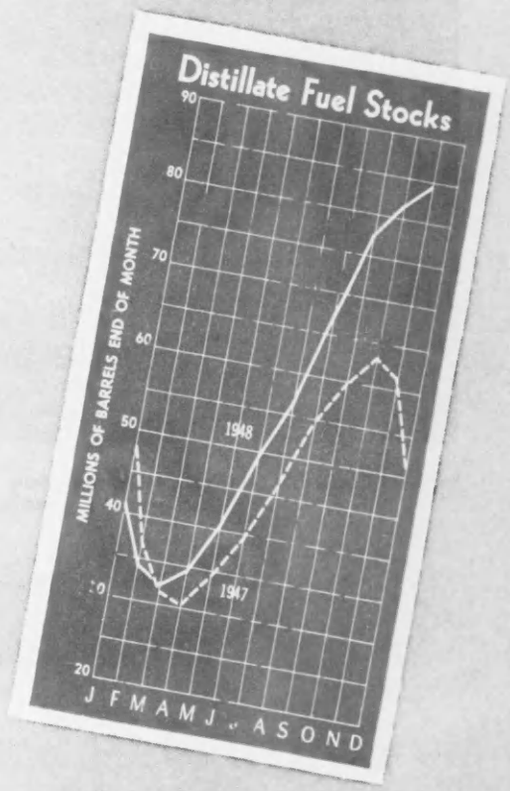
Daily runs to refinery stills averaged 5,682,000 barrels to hit a new record-high for refining operations. These daily charges amounted to only 2000 barrels a day more than domestic crude oil production during the month, making additions to refinable crude stocks possible.

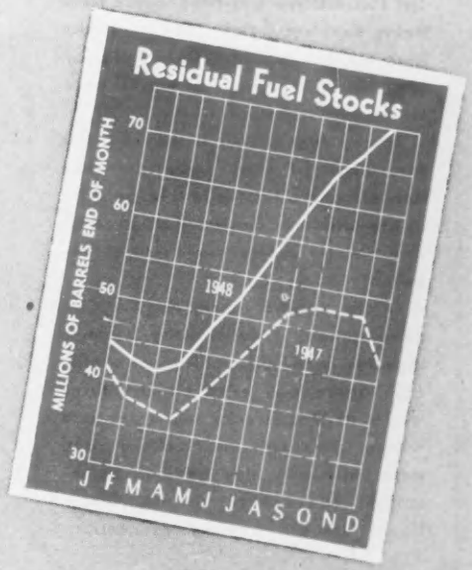
Crude stocks rose 3,299,000 barrels during the month ending at 234,305,000 barrels, the highest stocks level since June of last year. Not included in this total were 9,694,000 barrels of heavy non-gasoline bearing stocks being held in California.

Distillate fuels or light heating oils are now in good supply, their stocks having been built to 84,655,000 barrels and were just beginning to show withdrawals at the end of November. Last year, when these fuels were short in supply, the peak in stocks was reached in October and then amounted to only a little over 63 million barrels. So this winter season starts with over 20 million barrels more than were on hand at the outset of last heating season.

The heavier residual oils are in even better position. Stocks of these fuels now total 76,579,000 barrels, while their high point last year was less than 53 million barrels.

Gasoline in storage now amounts to 94,416,000 barrels and has just begun to accumulate. Stocks a year ago amounted to 6,865,000 barrels less than that amount.

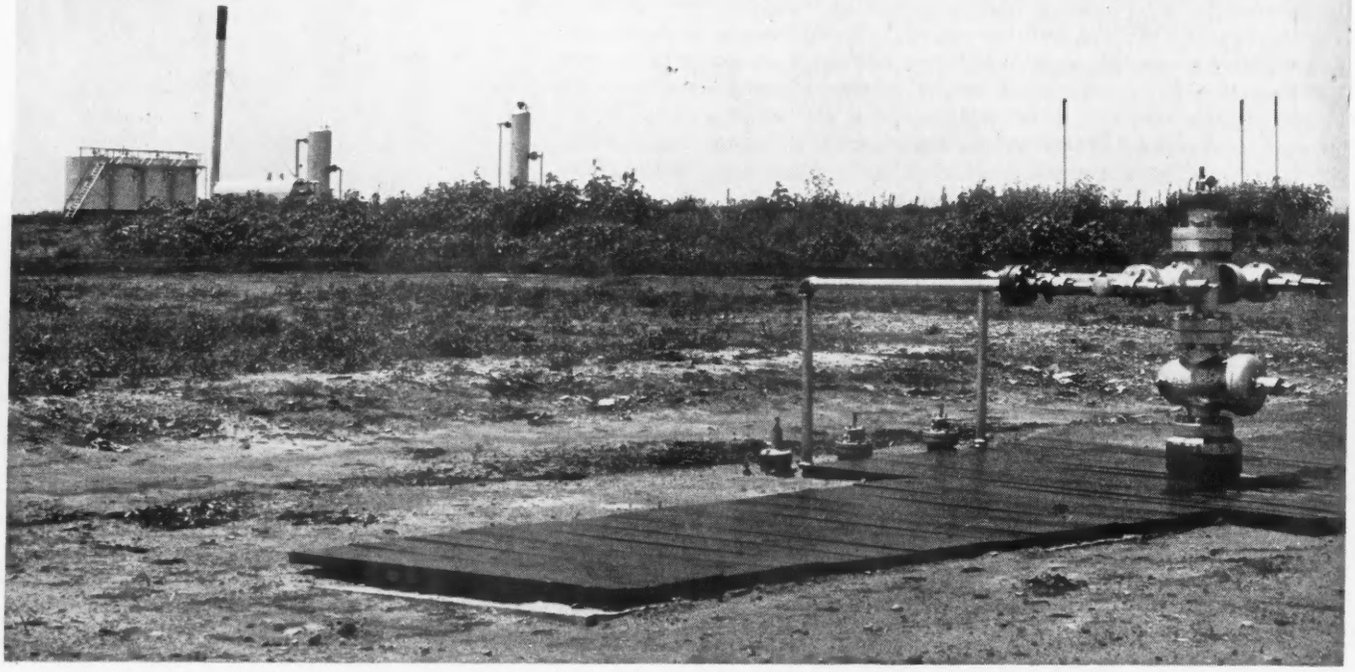




State Crude Oil Production
(THOUSANDS OF BARRELS)

STATE or DISTRICT	DAILY AVERAGE PRODUCTION				TOTAL FIRST ELEVEN MONTHS		
	Nov., 1948	Oct., 1948	Nov., 1947	% Diff. Nov., '47-'48	1948	1947	% Diff. '47-'48
Alabama	1.3	1.4	1.2	+ 8.3	431	356	+ 21.1
Arkansas	85.8	86.1	85.5	+ 0.4	28,843	27,320	+ 5.6
California	961.9	932.9	929.6	+ 3.5	310,739	304,359	+ 2.1
Colorado	51.4	48.5	46.8	+ 9.8	15,668	14,320	+ 9.4
Florida	0.8	0.8	0.8	.....	261	236	+ 10.6
Illinois	180.9	181.2	174.9	+ 3.4	59,154	60,878	— 2.8
Indiana	26.2	25.9	13.9	+ 88.5	6,264	5,406	+ 15.9
Kansas	291.5	301.7	294.7	— 1.1	100,516	96,337	+ 4.3
Kentucky	24.3	24.4	25.7	— 5.4	7,883	8,581	— 8.1
Louisiana	508.5	497.5	465.6	+ 9.2	164,676	145,647	+ 13.1
North Louisiana	116.1	115.6	108.2	+ 7.3	39,178	33,130	+ 18.3
South Louisiana	392.4	381.9	357.4	+ 9.8	125,498	112,517	+ 11.5
Michigan	46.7	46.4	45.6	+ 2.4	15,321	14,751	+ 3.9
Mississippi	131.5	129.1	108.3	+ 21.4	41,755	31,708	+ 31.7
Missouri	0.2	0.2	0.2	.....	49	50	— 2.0
Montana	26.4	25.6	24.3	+ 8.6	8,556	7,927	+ 7.9
Nebraska	0.4	0.4	0.7	— 42.9	195	208	— 6.3
New Mexico	134.6	133.5	121.4	+ 10.9	43,639	37,277	+ 17.1
New York	13.7	14.0	12.0	+ 14.2	4,328	4,341	— 0.3
Ohio	9.3	9.4	8.3	+ 12.0	3,043	2,823	+ 7.8
Oklahoma	441.8	433.0	400.6	+ 10.3	140,257	128,328	+ 9.3
Pennsylvania	31.7	32.7	33.2	— 4.5	11,519	11,606	— 0.7
Tennessee	.....	.....	.....	.....	7	7	.....
Texas	2,546.0	2,527.6	2,359.2	+ 7.9	824,210	745,771	+ 10.5
Dist. 1—South Central	27.7	28.5	24.6	+ 12.6	9,169	7,350	+ 24.7
Dist. 2—Middle Gulf	180.2	181.8	162.2	+ 11.1	58,734	52,213	+ 12.5
Dist. 3—Upper Gulf	517.5	516.8	487.0	+ 6.3	167,362	159,704	+ 4.8
Dist. 4—Lower Gulf-S.W.	257.4	256.6	253.9	+ 1.4	85,125	80,104	+ 6.3
Dist. 5—East Central	52.1	51.4	41.5	+ 25.5	15,888	12,965	+ 22.5
Dist. 6—Northeast	426.0	427.6	421.9	+ 1.0	144,056	144,816	— 0.5
Dist. 7-B—North Central	58.2	57.5	41.4	+ 40.6	16,373	12,875	+ 27.2
Dist. 7-C—West Central	48.9	47.8	41.7	+ 17.3	15,063	12,421	+ 21.3
Dist. 8—West	746.7	728.6	643.5	+ 16.0	232,420	185,844	+ 25.1
Dist. 9—North	142.6	142.4	133.6	+ 6.7	46,851	43,722	+ 7.2
Dist. 10—Panhandle	88.7	88.5	88.1	+ 0.7	29,106	28,539	+ 2.0
Utah	0.2	0.2	.....	.....	12	.....	.....
Virginia	0.1	0.1	.....	.....	31	60	— 48.3
West Virginia	7.6	8.1	6.9	+ 10.1	2,484	2,379	+ 4.4
Wyoming	157.2	160.7	131.8	+ 19.3	49,951	39,988	+ 24.9
Total United States	5,680.0	5,621.4	5,291.2	+ 7.3	1,839,792	1,690,664	+ 8.8

Shell Starts To Prove Rich Condensate Area



Shell Oil Company's Beckham County, Oklahoma, discovery (above) appears to have opened one of the nation's largest and richest gas condensate reserves. It is capable of producing 110 barrels of condensate per million cubic feet of gas.

By ANTHONY GIBBON
Staff Writer

THE PROMISING gas-condensate field being developed near Elk City, Beckham County, Western Oklahoma, by Shell Oil Company is of significance from two viewpoints.

In the first place, it may be the forerunner of other important condensate and oil fields in a large area of the Anadarko Basin where production heretofore has not been established.

In the second place, the Elk City development is noteworthy because it points to the possibilities of profitable operations even on structures where drilling is very expensive and where pressure maintenance and gasoline plants may have to be installed to recover the petroleum liquids and gases of the reservoir.

IN FAR western Oklahoma, many miles from oil production, Shell Oil Company has authorized a drilling program which may prove up one of the largest and richest gas condensate reserves ever discovered in this country.

Operations thus far have received little publicity because Shell officials and engineers want to be absolutely certain that their calculations are justified before announcing the results of their work. However, considerable optimism prevails in the Tulsa headquarters, which will get credit for the strike if current expectations are realized.

Shell's stake comprises about 28,000 acres located five miles south of Elk City in Beckham County. The play is given added significance due to the fact that it lies within the western bounds of the Anadarko Basin and just north of an imaginary "abyssal line," i.e., a geological demarkation between the shallower formations to the south and the steeply plunging formations which trend northward toward thick sedimentary beds where geologists hope to find many new oil and gas fields.

The area is about 15 miles northeast of the Sayre gas field and about twice the distance from the Eric pool, which produces gas and condensate from deep Pennsylvanian horizons. Other scattered gas production spots the south and central portion of Beckham County and some oil has been discovered on the southwest flank of the Sayre gas pool. But nothing so far appears to approximate the potential importance of Shell's Elk City play.

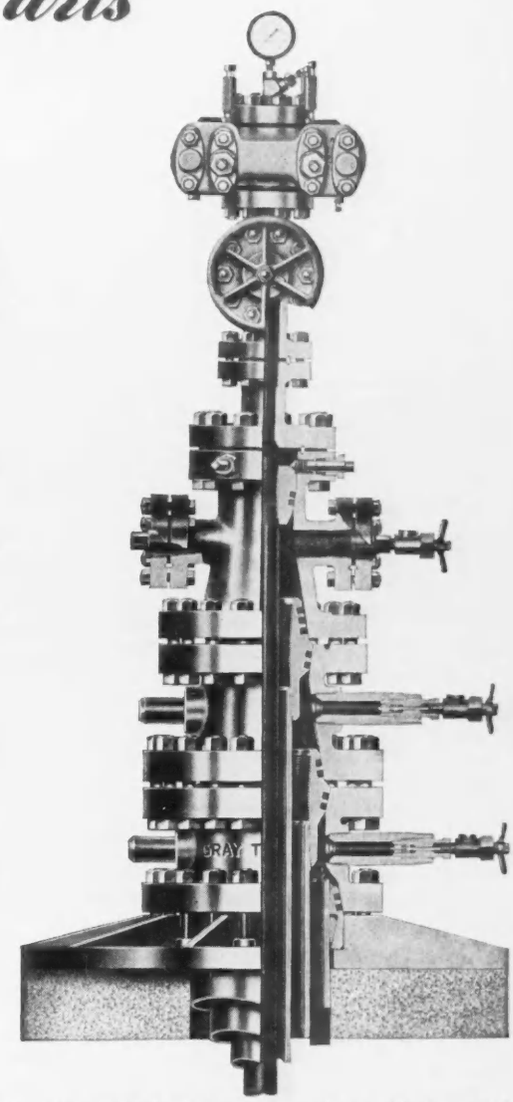
The area was opened with the completion of J. G. Walters 1, C-NE-SW

Fine Individual Parts

plus

CO-ORDINATION

Responsibility for strength at the weak point—the connection between individual parts—accompanies the unit responsibility of co-ordination. It eliminates the danger incurred from assembling a heterogeneous set of unrelated fittings and connections. Co-ordination of fine individual parts into a unitary whole achieves economy and increases operating efficiency.



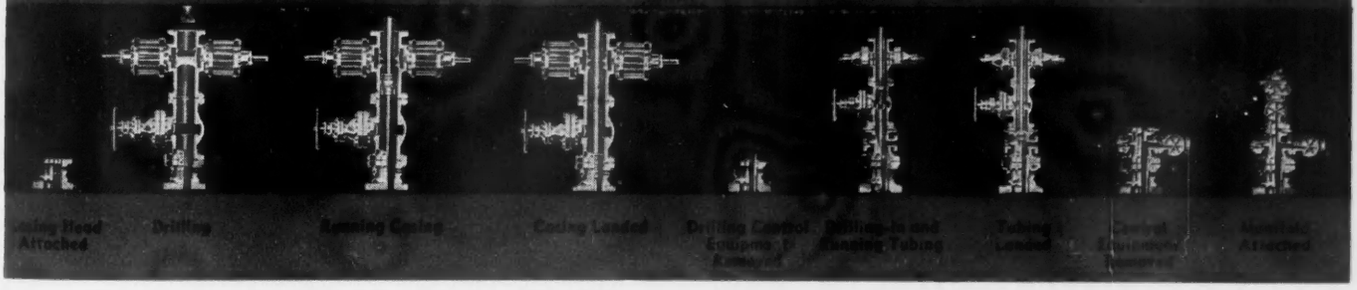
Complete Well Head Assembly equipped with Type 3170 Composite Manifold, Valve Removal, Installation and Renewal and Boll Weevil Casing and Tubing Hangers.

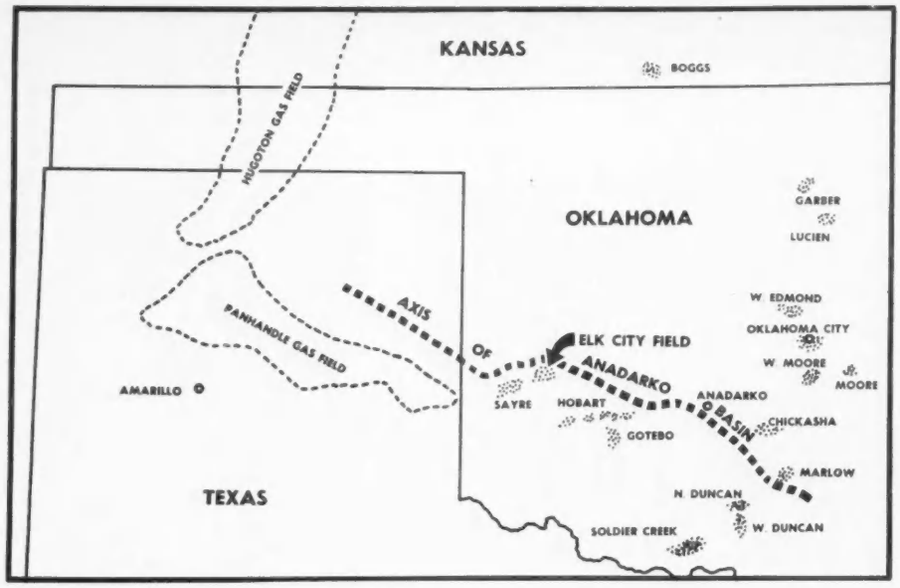
GRAY TOOL COMPANY

HOUSTON

Export Representative: GUY E. DANIELS, 30 Rockefeller Plaza, New York City

Rocky Mountain Representative: CARL MOULDEN, P. O. Box 1690, Casper, Wyoming





Shell's important wildcat strike is located in far western Oklahoma. It is many miles from oil production and about 15 miles northeast of the Sayre gas field.

14-10n-21w, drilled at a cost of $750,000. The well was drilled "tight" and aroused considerable speculation among Oklahoma oil scouts and operators. Shell declined to reveal drilling information but reported that location had been predicated on a seismic survey which indicates the existence of a large anticline, most of which is blanketed by Shell leases, although other interests hold scattered acreage on the structure.

The Walters well, completed in December, 1947, after a two-month testing period was shutin in February so that the company might formulate an exploratory program to determine the characteristics and extent of the reservoir. W. A. Alexander, manager for Shell in the Tulsa area, pointed out at the time that an enormous waste of condensate and gas would have resulted had the well been allowed to produce while engineers were assembling data. Alexander also stated that although it is not possible to determine whether cycling of the gas might prove the best method of producing the reservoir until more wells are drilled, if the field lives up to expectations, an extremely large capacity gasoline plant would be required to obtain the greatest distillate recovery from the gas produced.

The discovery well was completed from 9260 to 9360 feet in the Granite Wash formation of Pennsylvanian Age after drilling to 13,133 feet, total depth. It is capable of producing approximately 110 barrels of condensate per million cubic feet of gas produced under ideal conditions. Ordinary separation methods which had to be employed during the testing period resulted in a distillate production of approximately 76 barrels of condensate per million cubic feet of gas.

Engineering data indicated that the reservoir is of the retrograde type which must be produced under pressure to avoid underground waste. Shutin bottomhole pressure at the Walters well at 9337 feet was 3996 pounds per square inch and, flowing at the rate of 235 barrels of condensate and 3.1 million cubic feet of gas daily through ¼-inch choke, was 3695 pounds per square inch. Casinghead and tubing pressures were 2706 and 2601 pounds, respectively, during flow test.

Shell signed a contract with the Big Chief Drilling Company of Oklahoma City to drill a second well one mile west of the Walters and a third well one mile south of the discovery. Locations were spaced a mile apart so as to prove or disprove the existence of a major structure. Only by carrying out such a bold program can the company obtain the information upon which to justify the expenditure of large sums in installing the type of plant which engineers feel will be necessary in order to obtain optimum recovery from the reservoir.

As drilling proceeds in the block, Shell plans to shut in each well as it is completed until the field is fully defined; however, officials emphasized that the company fully intends to place the field in production as soon as sufficient data are gathered, justifying the expenditure of several million dollars for a processing plant. This decision was reached after full consideration and discussion with the Corporation Commission and represents the best solution in the interest of conservation and of providing the best return for all interested parties.

The Foremen

■ CONTINUED FROM PAGE 37

schemes to encourage attendance at the meetings and abet loyalty to the company are taboo.

The men in ultimate responsibility for the program of which the foremen's meetings are a part are R. Ogarrio, vice president of the Producing department with headquarters at New York; and Filley, whose headquarters are at Houston. Because of practical considerations, the Pacific Coast division foremen's meetings are under the supervision of Ogarrio, while Filley is in charge of the South Texas, Louisiana, Oklahoma, West Texas and Rocky Mountain divisions.

Whetsell, the director of the industrial relations program, is aided by Joe A. Hale, whose title is Assistant Departmental Supervisor of Industrial Relations.

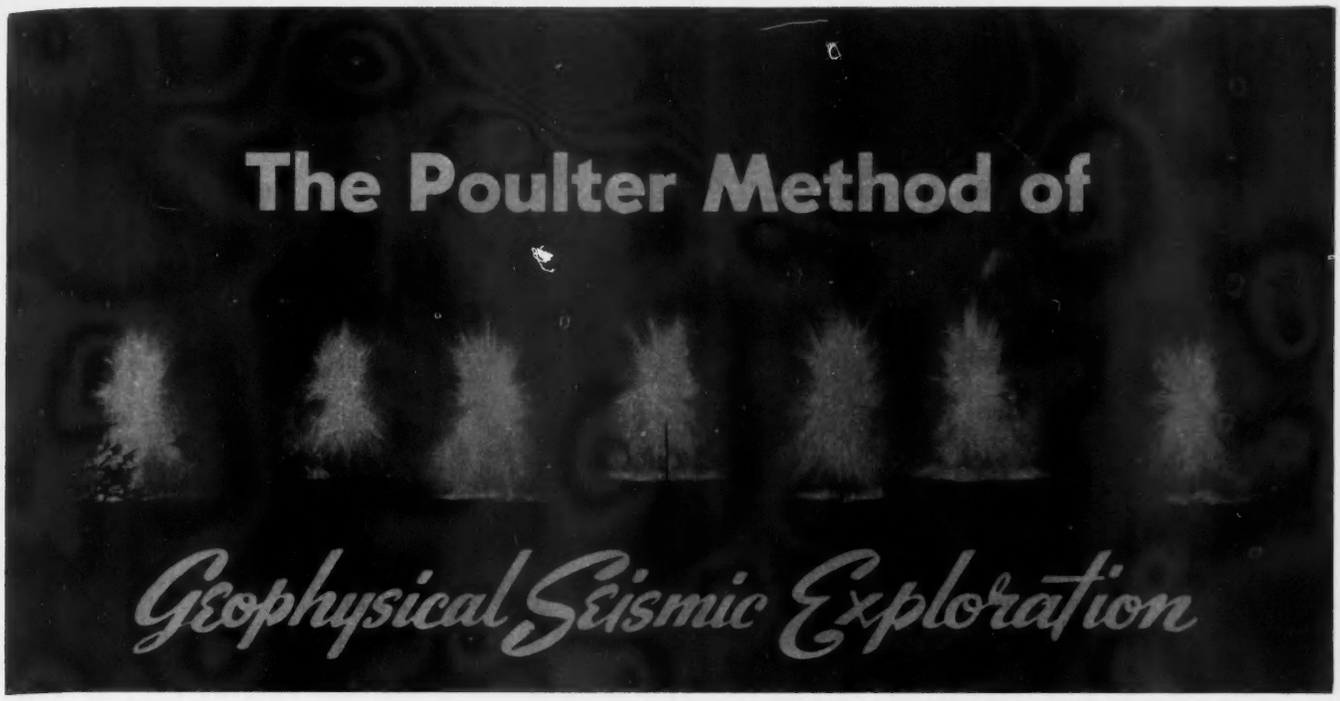
It is a company policy that the men who fill the important posts of division supervisors of industrial relations be well grounded in other phases of company work. Oscar Hillyer, Jr., South Texas division supervisor, was in the Operating department, then a safety engineer. Walter Allred of the Louisiana division followed the same path. W. B. Cooper of the Oklahoma division was head of the pay roll section at Tulsa. S. F. Chamberlin of the Rocky Mountain division was in the payroll department at Tulsa, then entered the Army, where he did personnel work and emerged as a captain.

A departure from the organization's general pattern is the position of assistant supervisor in the South Texas division. This job is held by E. E. Callaway.

Each of the Houston area's five divisions is divided into three districts, each of which holds three, and sometimes four, meetings per year. The Rocky Mountain division, because of vast distances and frequently bad weather, holds few district-wide meetings but gathers its foremen in smaller groups. In all five divisions there were 85 meetings with a total attendance of 2,464 during 1947.

In general, the Producing department foremen's meetings are for field supervisory forces in production and exploration. Specifically, those eligible to attend are the district superintendents and his staff, which includes the district petroleum engineer, district clerk and his assistant, district geologist, district landman, district civil engineer, district warehouseman and drilling foreman, and in addition, the field foremen, production foremen, head roustabouts, field petroleum engineers and field clerks-warehousemen.

The Poulter Method of Geophysical Seismic Exploration



Time exposure of a night explosion of a seven-charge pattern used in the Poulter Method. Direction of force emanating from each explosive charge is clearly shown. Note that very little of the force is directed laterally, but up and down.

By J. E. KASTROP
Staff Writer

SCIENTIFIC INVESTIGATIONS reveal that explosive energy can be utilized more efficiently in geophysical seismic exploration when charges are suspended above ground in a geometric pattern. These studies, stemming from seismic experiences in the frozen reaches of Antartica, hold promise of faster, cheaper and more reliable seismograph surveying, not only in areas favorable to this type of geophysical exploration, but in areas heretofore unresponsive to the seismograph.

OBSERVATIONS of acoustical phenomena in the upper crystalline snow layers by Dr. Thomas C. Poulter during the second Byrd Antarctic Expedition (1933-1935) gave impetus to extensive investigations of suspended charges which now promise to provide the industry with the most important discovery in geophysical exploration methods since the development of the flying magnetometer.

The Poulter discovery derives its importance from three distinct aspects of seismic exploration. By suspending the charges which originate the small earth tremor, more efficient use is made of the explosive energy produced when these charges are detonated simultaneously. An obvious advantage gained by this method, and one which will undoubtedly influence to a large degree its application in the field, is the elimination of shot holes in which to place the explosives used in current seismograph surveying practices. It has been estimated that the cost of drilling shot holes for seismograph work ranges from one-third up to one-half the total cost of a survey. A third, yet none-the-less important advantage of suspended charges, lies in the method's ability to produce useable or "readable" reflection and refraction records in difficult areas where conventional shot-hole shooting produces a confused record, the interpretation of which is uncertain.

Early Uses of Suspended Charges

The suspension of individual explosive charges above ground in order to create the small earth shock necessary for seismic measurements was used in the past by several geophysicists. This alternative practice, however, came about as a necessity rather than a directed effort toward a scientific discovery. In certain areas, these geophysicists as well as party chiefs hung large charges of explosives on barbed wire fences because the surface rock was too dense to drill a suitable shot hole within a reasonable length of time. Others used the method in swamps where it was almost impossible to secure an hydraulic pump for jetting a satisfactory hole. For these and other reasons, single charges have been detonated from an elevated position, but a scientific study of the resulting phenomena and their practical application to seismic exploration problems remained unattended until recent years.

The particular phenomena which led to investigations on suspended charges were noted by Dr. Poulter in the frozen wastes of the South Pole. He accompanied Adm. Richard E. Byrd on his second expedition into Antarctica, where he served as senior scientist and second in command. Modified seismograph equipment was used to investigate the much-discussed Ross Shelf ice. In setting up their main operations camp, it was necessary to cut tunnels in the coarsely crystalline snow for communications between the camp buildings and the magnetic observatory. It was found that conversation in the 2½-foot wide by seven-foot high tunnel was difficult at

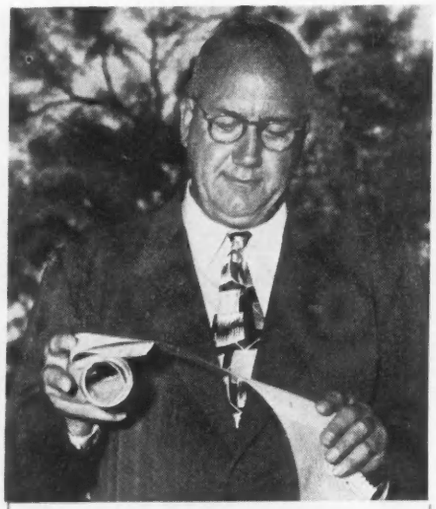
distances of 15 feet. At 25 feet apart, it was almost impossible for two people to understand each other. The snow exhibited extremely good acoustical absorption characteristics.

A second strinking observation was also made in these snow tunnels. The sound of men digging trenches in the snow about 600 feet away could be distinctly heard by those in these tunnels. This peculiar phenomenon was encouraging to those explorers who found that the snow exhibited excellent sound transmission characteristics. However, when a half-pound charge was placed in a 2½-foot deep hole and covered with snow, the explosion was barely audible at a distance of 50 to 100 feet away, and the snow tamp on top of the charge was not blown from the hole. Upon investigation, it was found that a spherical cavity eight to 20 inches in diameter had been blasted.

Burying explosive charges in the snow proved a very inefficient method of setting up an energy wave for seismic measurements. The porous snow served as an ideal condenser for the hot gases generated. Further investigations showed that the relative amounts of energy detected by geophones placed 1000 feet from a half-pound charge buried 2½ feet in the snow and the energy picked up from a shovel striking the snow the same distance from a geophone were practically identical. A timing wire attached to the shovel and one laid on the snow introduced a timing mark on the recorder when the shovel struck the snow. Through this somewhat crude arrangement, it was not difficult to obtain good reflections through 1000 feet of ice and snow and 2000 feet of water.

Charges Suspended Over Snow

Realizing that very little energy was transmitted into the snow by buried charges, Dr. Poulter and his party experimented with other ways of creating the shock wave. Based on experiences with the energy transmitted into the snow by striking the surface with a shovel, charges were laid on the snow and detonated. Other charges were suspended on stakes several feet above the snow and exploded. Geophones were placed at various distances and many such experiments tried. The relative amounts of energy transmitted through the snow were then measured for many different sets of conditions.



DR. THOMAS C. POULTER, Ph.D., Sc.D. and Associate Director of Stanford Research Institute, examining one of the first refraction records obtained with the new method of seismic exploration bearing his name. Dr. Poulter served as second in command and senior scientific adviser on the second Byrd Ant-Arctic Expedition (1933-1935), and is the recipient of two Congressional Medals of Honor. From 1936 to 1948 he was Associate Director of the Armour Research Foundation. He has been head of the division of physical sciences, mathematics and astronomy at Iowa Wesleyan College. He is an authority on organic chemistry; electrical, chemical, physical and optical effects at extremely high pressures; Antarctic meteor and auroral phenomena; geophysics; glaciology; terrestrial magnetism, and seismology.

In the summer of 1947, Dr. Poulter presented a plan for researching his concept of a more economical method of geophysical seismic exploration tc the Institute of Inventive Research in San Antonio. The Institute, endowed by Tom Slick, Texas oil man and rancher, arranged to retain Dr. Poulter to conduct the experimentation necessary to determine its value and practicability.

Results of these combined studies showed that the amplitudes of the reflected waves generated by suspending the charges in air were two to three times the amplitude of those obtained by any other method. These observations, briefly outlined above, made in the course of mapping the ice-water and water-ground and ice-ground contacts in Antartica by the seismograph method provided the basic work which led to the investigations and results herein described.

A great many fundamental studies were involved in the development of this new method of geophysical exploration. Studies were made of the manner in which the energy from an underground explosion was absorbed. It was found that as much as 95 percent of the energy may be absorbed within a few feet of the charge in crushing the rock or other surrounding material. A further study was made into absorption of the energy which was converted into seismic wave motion in the earth. To reduce the problem to its simplest form, studies were made on the transmission of sound on seismic waves through dry sand of a uniform grain size. These tests showed that there is very little absorption if the amplitude or intensity of the sound is very low. If the intensity of the energy wave is high, as little as 5 percent or less may be transmitted, but if the intensity is low, as much as 95 percent of the energy may be transmitted.

Further studies showed that, other things being equal, the larger the particle size, the less the absorption. This means that the intensity can be greater before absorption becomes excessive. In the weathered or unconsolidated layers where there is a mixture of particle sizes, the absorption covers a wider intensity range. But in all cases, if the amplitude of the energy waves is sufficiently low, the seismic waves will be transmitted comparatively well.

These experiments showed that if an explosive charge is buried just beneath the ground surface, so much of the energy will be absorbed in the weathered layer that there is not enough remaining to penetrate to the desired strata and reflect back even though the transmission characteristics of the underlying strata may be good. This absorption phenomena is not overcome altogether

Call out the AUTOCARS when the going gets tough

Transporting drilling equipment calls for back-breaking loads, and on-highway as well as off-highway hauling. That kind of work calls for Autocar versatility . . . axle ratios that permit time-saving speeds when the road says "go," and the built-in stamina that withstands the roughest off-highway conditions.

Here's hauling equipment at work on a job for which it's pre-eminently suited. A giant Model DC-10064-S Autocar-Diesel moving a drilling rig. It's owned by J. C. Gauvey, oil field trucking contractor and general hauler, Eunice, New Mexico.

AUTOCAR TRUCKS

THEY COST LESS, BECAUSE THEY DO MORE WORK

MANUFACTURED IN ARDMORE, PA. • FACTORY BRANCHES AND DISTRIBUTORS FROM COAST TO COAST

This view, taken an instant after the initial explosion, shows puffs of smoke rising from a 13-shot pattern. Close examination showed that the dried grass directly below each charge was not even scorched as might be expected.

simply by reducing the intensity or amplitude at a point on the surface.

Energy Losses in Shot-hole Blasts

Explosions which occur under the surface create energy waves of mixed frequencies. It has been found that those of high frequencies are attenuated before they penetrate to an appreciable depth, thereby nullifying their usefulness in seismic work. Because the force of the energy wave per unit of area in an underground explosion is so great, much of this energy is absorbed in the immediate area of the blast, thereby considerably reducing the amount of energy remaining that can be used for seismic measurements. There is an additional loss in shot-hole explosions which also accounts for much of the expended energy. As the energy wave travels outwardly from the shot point, its intensity or amplitude decreases as the square of the distance from the shot point. These three sources of energy losses are always present in greater or lesser degree in shot-hole explosions.

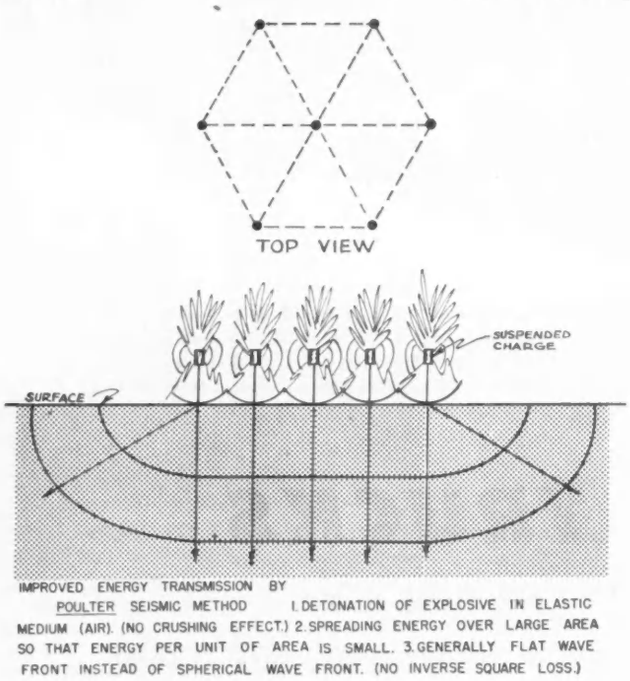
The loss of this explosive energy can be minimized by detonating the charge in air several feet from the ground. An energy wave of high intensity is set up, but due to the extreme elasticity of air, very little of the wave is absorbed by the air. The amplitude is greatly reduced to a point where a maximum of energy is transferred into the ground. Since air is so elastic, the total energy in the air wave remains almost constant even after it has traveled over relatively long distances.

By spreading this energy over a relatively large circular area on the ground the energy per unit area may be small, but the total force over this area can be made quite large. When seven to 19 charges are suspended in a symmetrical pattern so that lines connecting adjacent charges form an equilateral triangle, and when detonated simultaneously, the energy wave created gives the earth a "slap" or instantaneous jar of almost equal intensity over an area somewhat larger than the charge pattern. The simultaneous impact of all charges tends to set up in the earth energy waves which have essentially the shape of a huge bowl. The wave front which progresses directly downward from the surface impact area is practically flat. The edges of these waves curve up toward the surface. It is estimated that for the 13-shot pattern, approximately 1 million pounds of force strike the ground from the suspended charge method for every pound of explosive used. This essentially flat wave front produced by exploding the charges in a pattern above ground tends to minimize the inverse square energy loss. Inasmuch as the intensity of the energy wave is reduced by the elasticity of air, the attenuation losses are also reduced. By spreading the total force, which sets up the energy wave in the earth, over a relatively large area, the absorption loss is also appreciably lessened.

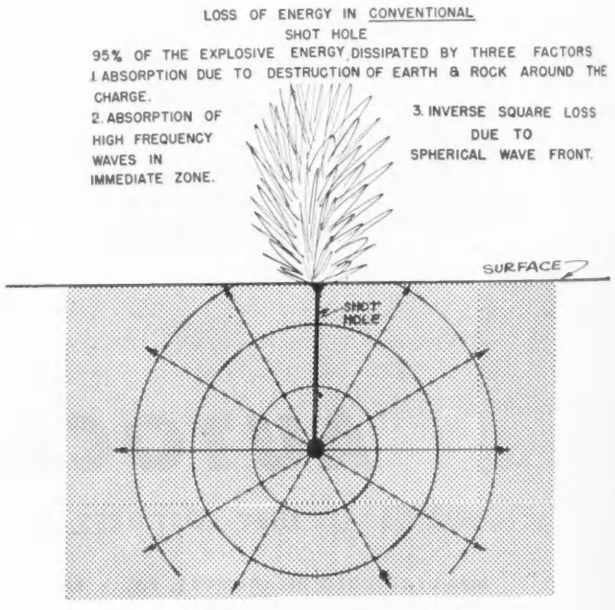
Methods of Generating Energy Wave

Several methods which generate such energy waves were studied and other methods were developed. A modification of the Monroe effect provided an effective method for this purpose. Instead of producing a long, narrow jet, one type charge studied was modified to create an umbrella-shaped explosion pattern. By elevating a single shaped charge several feet above ground, a flat wave front approximately 80 feet in diameter could be produced. While good reflections could be obtained by detonating single charges, other types of charges fired singly or in multiples were found to be more convenient in actual field practice.

Flat circular charges were made from high-velocity explosions detonated from a point several feet from ground, and

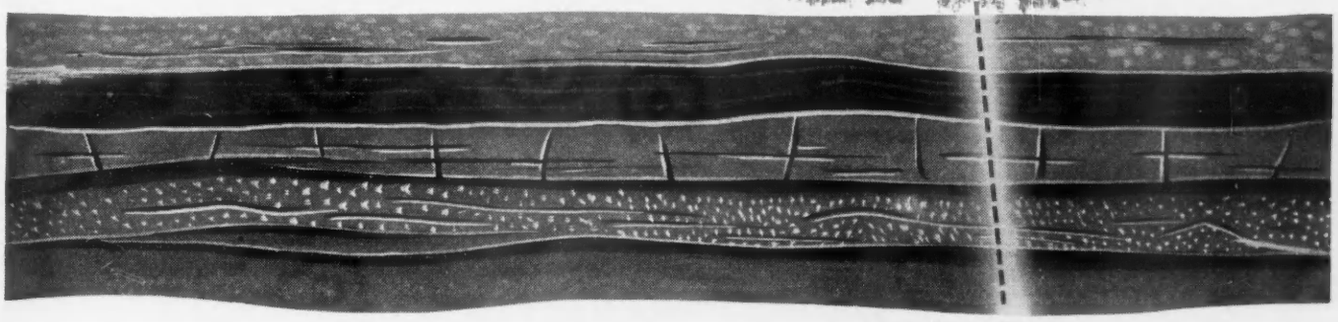

TOP VIEW
SUSPENDED CHARGE
SURFACE
IMPROVED ENERGY TRANSMISSION BY POULTER SEISMIC METHOD 1. DETONATION OF EXPLOSIVE IN ELASTIC MEDIUM (AIR). (NO CRUSHING EFFECT.) 2. SPREADING ENERGY OVER LARGE AREA SO THAT ENERGY PER UNIT OF AREA IS SMALL. 3. GENERALLY FLAT WAVE FRONT INSTEAD OF SPHERICAL WAVE FRONT. (NO INVERSE SQUARE LOSS.)

Suspended charge.
Energy wave expanding a flat front in a homogenous layer from a 7-charge shot pattern.


LOSS OF ENERGY IN CONVENTIONAL SHOT HOLE
95% OF THE EXPLOSIVE ENERGY DISSIPATED BY THREE FACTORS
1. ABSORPTION DUE TO DESTRUCTION OF EARTH & ROCK AROUND THE CHARGE.
2. ABSORPTION OF HIGH FREQUENCY WAVES IN IMMEDIATE ZONE.
3. INVERSE SQUARE LOSS DUE TO SPHERICAL WAVE FRONT.
SURFACE
SHOT HOLE

Buried shot.
Energy wave expanding in a sphere around shot point in homogeneous layer.

THE SHOT That Blasted RUMOR



Leads the way to Greater Oil Progress

It has long been the hope of the exploration industry to obtain seismic records from shots set off above-ground. Such a hope has at last become a reality and rumors have ceased to exist.

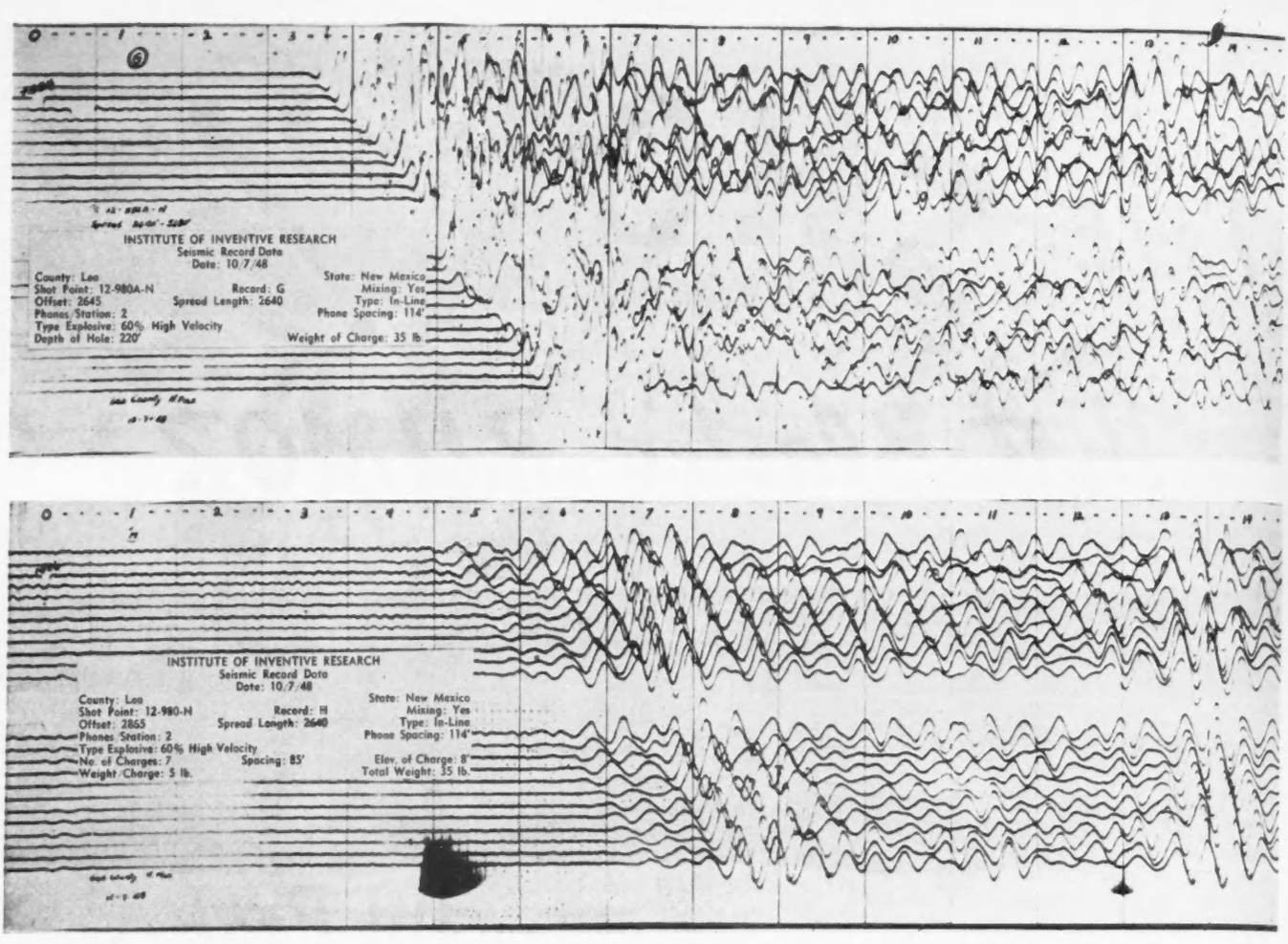
Republic Exploration has actively participated in the capacity of engineering development consultants assisting in field operations in bringing this revolutionary exploratory "looking glass" to the oil industry.

In the future as in the past Republic will expend its every effort to bring more progressive measures in the field of exploration to the oil world.

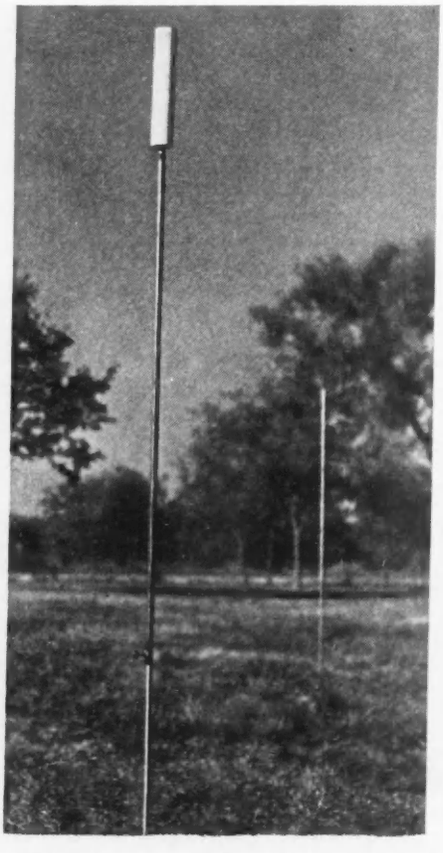
Rx

REPUBLIC EXPLORATION COMPANY

TULSA, OKLAHOMA



Comparative reflection records made by using both methods of creating earth tremor. Both records were made by the same modern recording equipment. The top record resulted from shooting a 35-pound charge in a 220-foot shot hole. The lower record was made by the Poulter method, requiring the same amount and type of explosive. Both records were made at the same location with the same spread and the same phone spacing. The top record illustrates the difficulty of obtaining good seismic reflection records in this particular area, while the lower record demonstrates the advantage of the Poulter method.



A single charge support in a 13-shot pattern. A ½-inch solid iron stake is driven in the ground and a section of ¾-inch black iron pipe placed over it. A set screw, shown at the lower end of the pipe, positions the charge at any desired height above the ground. A shoulder at the upper end of the iron pipe supports the cylindrical charge.

created energy waves that covered an area on the ground more than a thousand times the area of the charge. Charges made in this shape can be fired singly or in multiples of uniformly-shaped charges, depending upon the transmission characteristics of the weathered layer and the sub-strata.

Final developments of a practical method for generating a flat wave front resulted in using cylindrically-shaped charges. Studies on such shaped charges showed that maximum directional energy could be obtained from the explosion if the length of the charge was six to eight times its diameter. Charges thus shaped could be manufactured and handled with greater ease and convenience. These charges were supported in a vertical position by telescoping pipe rods driven in the ground in the desired shot pattern. The height at which each charge was suspended varied with the size of the charge. The amount of explosive used per charge and the total charge was determined by area conditions. Where the weathered layer is thick, larger individual charges and also total charge may be required. Experiments showed that, regardless of ground conditions, when using charges ranging in size from 2½ up to five pounds per charge, a maximum amount of usable energy was transmitted into the earth if the charges were suspended about six feet above ground. For charges larger than five pounds, it was found that a height of eight feet resulted in a maximum transmission of energy into the earth.

The accuracy of locating each charge in the circular or wagon-wheel pattern is not critical. Charges may be spaced up to 75 feet apart in areas covered with fairly soft ground, or ground that has a thick weathered layer. For a 19-shot pattern, such spacing would cover an area 300 feet in diameter. In such areas as the Edwards Plateau where the surface is extremely hard, charges may be spaced much closer together. Spacing and size of each charge and the number

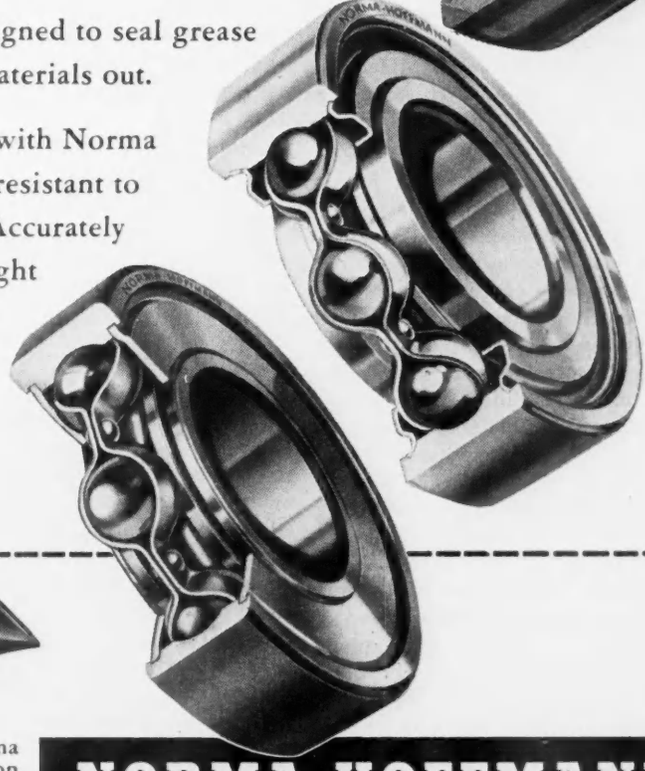
Efficient Seal Design PLUS Norma Stability-Tested Grease

ASSURE MAXIMUM TROUBLE-FREE BEARING LIFE

This all-important combination explains why Norma-Hoffmann sealed ball bearings perform smoothly and dependably for years on end.

First — the efficient seals are specially designed to seal grease in . . . keep dirt, dust and other harmful materials out.

Second — the bearings are factory packed with Norma "stability-tested" grease . . . grease that is resistant to oxidation and protects against corrosion. Accurately metered grease supply provides just the right amount of lubricant for each bearing . . . not too little, not too much . . . assuring efficient operation for long periods without regreasing.



NORMA "Stability-Tested" GREASE

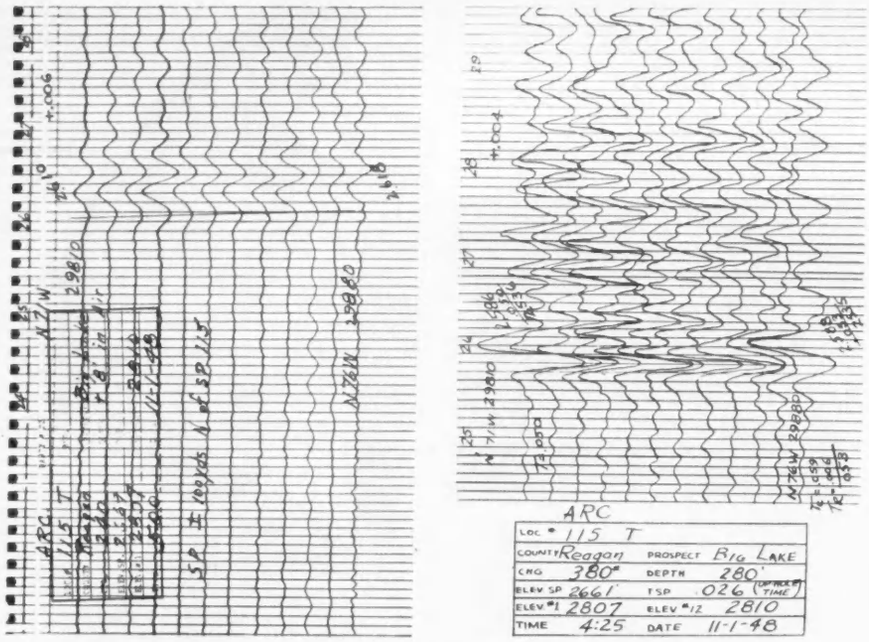
"No sealed bearing is better than its lubricant!" Norma "Stability-Tested" Grease provides correct lubrication over a wide temperature range. Especially developed by Norma-Hoffmann, this water-resistant grease is filtered dirt-free and milled to the proper consistency. It has maximum resistance to oxidation and breakdown . . . keeps its excellent lubricating properties over many many years without drying out or hardening.

NORMA-HOFFMANN *Precision* **BEARINGS**

BALL • ROLLER • THRUST

NORMA-HOFFMANN BEARINGS CORPORATION
Stamford, Connecticut

Field Offices: New York • Chicago • Cleveland • Detroit • Pittsburgh • Cincinnati • Los Angeles • San Francisco • Dallas • Seattle • Phoenix



Comparative refraction records made by conventional shooting methods (shown at right) and the Poulter Method at left. These records were among the first experimental ones made. The test location was approximately two miles southwest of Big Lake, Texas, in Reagan County. All twelve geophones were placed on an arc spread with a 30,000-foot radius and with pickups 500 feet apart. For the conventional shot, 380 pounds of explosives were placed in a 280-foot deep shot hole. The Poulter Method required only 240 pounds (combined charge) of the same explosive, with each charge suspended 8 feet above ground. Wind velocity was recorded at 40 miles per hour.

of charges required will be determined by the surface coverage. The total amount of explosive used in the Poulter Method varies with surface and subsurface layers. In some areas, only 25 percent of the charge used in conventional shooting will be required by the suspended charge method. However, in other areas, the same amount of explosive will be needed in both methods.

Velocity of the energy wave in air makes it necessary that all charges be detonated within an elapsed time not exceeding one-ten-thousandth of a second. In cooperation with explosive engineers, two methods were devised to produce such an instantaneous explosion. One such method incorporates standard blasting caps and a modified blasting machine, while a second method utilizes a standard blasting machine and a modified blasting cap. The latter are inserted in the upper end of the suspended charge and are connected in series to the blasting machine. Experiments show that the speed of the explosion is not too important. It is important, however, that all charges in the shot pattern do explode at almost the same instant. It was found that slow explosives, such as those used in coal mines, produce as satisfactory a record as do the high-velocity charges. This is considered a distinct advantage and should result in considerable saving in the cost of explosives.

Many Advantages Realized

No modification of any kind is required of the standard seismic equipment, whether it be purchased from a manufacturer or assembled by the user. The usual shot-hole drilling equipment and accessories are entirely eliminated. This feature offers exceptional advantages in foreign countries as well as in other areas which are difficult to reach with heavy equipment. Since no drilling equipment is needed, the procedure of operation is made more flexible, and the shooting party can work more closely with or even be combined with the surveying party. If it is found that additional shot points are desired, they can be introduced without having each of the three groups return to that point. The Poulter Method holds another advantage in that several shots can be made at the same shot point to obtain comparable results without the variation that inevitably occurs in successive shots in a hole, or the danger of losing the hole completely and having to redrill it. Test shots made in cultivated areas showed that very little damage, if any, is incurred by the plant life on the surface immediately below each suspended charge.

The Poulter Method has been tested extensively in the most difficult areas known to seismic surveying in Texas and New Mexico. Satisfactory records were obtained from the Edwards Plateau region in Texas. Experiments in this area indicated that good seismic records can be obtained by this method employing a total charge of only 130 pounds. Up to 19 charges were shot in one pattern. However, the general practice was to use seven or 13 charges per shot. Good results were obtained in the caliche-covered areas of New Mexico and West Texas where one crew has been utilizing the Poulter Method for eight months. The cost of drilling shot holes for one seismograph crew employing conventional methods in this same area amounted to about $20,000 per month. It was here that studies were made on the merits of placing the individual charges in line. Comparisons of records made by the circular pattern indicates that while the in-line pattern produces a usable record, it is inferior to the results obtained by the circular shooting pattern. It was definitely proved that superior records were obtained in this area by using the Poulter Method as compared with conventional shooting methods. This is true in other difficult areas where satisfactory seismograph records have not been obtained heretofore. In areas favorable to seismograph work, this new method has produced records which are as good as and in some instances better than records made by conventional methods.

Experiments to date employing the Poulter Method over water indicate that no damage to fish and marine life result from the energy wave set up in the water by detonating the charges suspended above the water by floating buoys. While the concussion wave sent out laterally from the explosion dies off rapidly, noise from the shot is somewhat greater than that heard from conventional shooting using the same total charge in both cases. For this reason, there may be some hesitancy to its use in populated areas. However, there has been little evidence of damage in any case, and there is little likelihood of damage unless the charges are placed close enough to buildings for the air wave to cause damage. The destructive ground wave created by the Poulter Method is considerably less than the ground wave created by shot-hole explosions.

Of the advantages described, two appear to be paramount. The savings in time and cost to drill shot holes ahead of the seismograph crews hold promise of lowering the steadily increasing cost of geophysical exploration surveying. The relatively large investment in shot-hole drilling equipment and accessory equipment will be eliminated. Important to those who interpret the data is the ability of the method to produce as good, if not better, data at a much faster rate than conventional shooting, as well as producing satisfactory seismic records from areas heretofore unresponsive to conventional seismic surveying methods.

ACKNOWLEDGMENT

Explosive engineers of the Du Pont de Nemours Company cooperated in the development of explosives used in this new shooting technique. The aid of Dr. Thomas C. Poulter and of the Institute of Inventive Research, San Antonio, in the preparation of this manuscript is gratefully acknowledged.

From A to Z

GET ADEQUATE ACCURATE ACTION

WITH ZEAL ZEST AND ZIP

In Oil Field Supplies . . .

Call BOVAIRD

SUPPLY BOVAIRD COMPANY

OFFICES AND STORES

ILLINOIS—Clay City, Grayville, Salem

KANSAS—Chase, McPherson, Pratt, Russell, Wichita

OKLAHOMA—Duncan, Oklahoma City, Pauls Valley, Sapulpa, Seminole

TEXAS—Borger, Dallas, Odessa, Pampa

✓ Whatever your needs for materials, machinery or methods in solving your oil field supply problem, contact your nearest Bovaird office or store.

✓ To better serve our growing list of customers in a growing petroleum industry, Bovaird now has seventeen offices and stores strategically located in Illinois, Kansas, Oklahoma and Texas.

✓ Bovaird's stocks and sales personnel are increasing; the lines we represent are growing; so are our sales and services.

✓ From the smallest item to carload shipments, Bovaird can serve your needs in the drilling, producing, pipeline or refining departments.

"Buy From Bovaird"

THE BOVAIRD SUPPLY CO.

GENERAL OFFICES: TULSA, OKLAHOMA

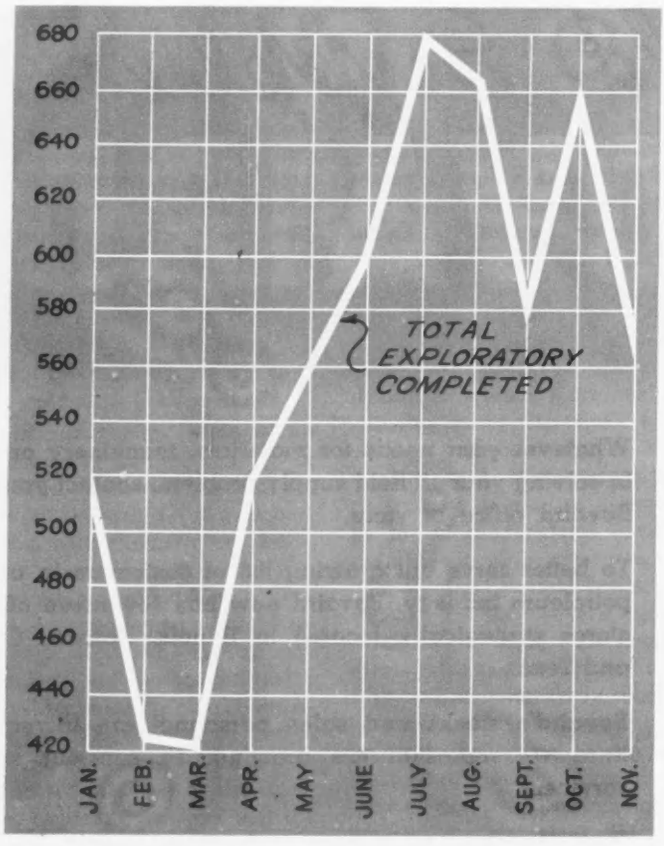
Exploratory Drilling

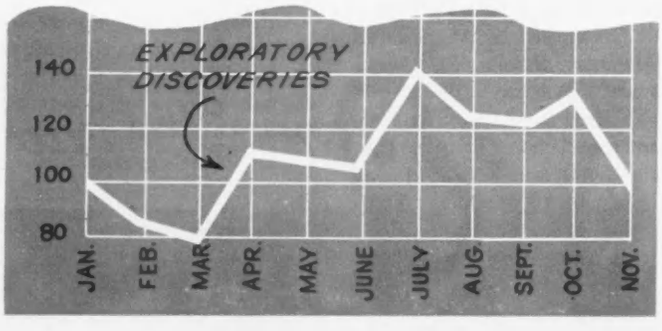
Continues to Find Many New Sources

By CECIL SMITH, Staff Writer

OIL production from three miles under the earth's surface seems probable as a Louisiana Coast well has tested good oil shows from sands less than a thousand feet short of that mark. In the same state another oiler has been added to the growing list of successful tideland ventures.

Southern Louisiana appeared to have the deepest oil producer in the world when Shell Oil Company tested 672 barrels of 44.5-gravity oil through perforations from 14,904 to 14,912 feet in its J. A. Smith 1-A well at Weeks Island field, Iberia Parish. However, final completion was made up the hole at 14,243-255 feet with a flow of 420 barrels of 33-gravity oil per day through a 12/64-inch choke. Had completion been made at the 14,912-foot level, Weeks Island would once again claim the world's deepest producer as it did from 1945 to 1947, but which is now Pure Oil Company's West Poison Spider field discovery in Wyoming that is producing from a depth of 14,307 feet.





Oil production has been confirmed in the Grand Isle Area, Block 10 field, eight miles off Louisiana in the Gulf of Mexico, by Humble Oil & Refining Company. The well was drilled off the same platform as the discovery and has been completed in a new deeper pay zone for the field. The company's Grand Isle State Lease Account 2 No. 3 was bottomed at 9424 feet in the salt and pipe was perforated from 9221 to 9236 feet for the completion. On a 24-hour gauge, the well flowed 625 barrels of oil per day through a 7/32-inch choke.

Gulf Oil Corporation is completing its S. S. Perry et al 1, a wildcat in Brazoria County, Texas Gulf Coast, which could possibly be the largest gas-condensate producer in the Coast area. Hole was drilled to 12,984 feet and at 10,866 feet operators were forced to cement 7-inch protective string, and from that point a 5-inch liner was cemented to 11,456 feet. The liner was perforated from 11,278 to 11,348 in the Lower Frio sand for the initial test and completion. The test developed around 7000 pounds working pressure, the contents of the flow being gas and condensate. The well is now shut in and pressure is reported to be 8375 pounds.

McKee Sands in Permian Basin

A new McKee sand pool has been opened in Lea County, New Mexico, by Continental Oil Company's Warren Unit No. 1-B-29. The discovery well is located in Section 29-20s-38e and is 1½ miles east of the Skaggs pool. On a three-hour test the well flowed 441 barrels of oil and 2.3 million cubic feet of gas through a one-inch choke from open hole between 8947 and 9070 feet.

In the West Texas part of the Basin a fourth oil pay zone, the McKee, has been added to the Block 31 field of Crane County by The Atlantic Refining Company. The well, University No. 2-31-F, a joint operation, was dually

SEISMIC

SUBSURFACE SURVEYS

✓ Modern Instrumentation

✓ Capable Personnel

✓ Years of Experience

SEISMIC EXPLORATIONS, INCORPORATED

Gulf Building Fort Worth, Texas

Established 1932

completed flowing 671 barrels of 45-gravity oil through perforations at 9634 to 9659 feet opposite the new zone and also 240 barrels from 8770 to 8860 in the Devonian. Other pays in the field are the Connell sand and Ellenburger.

In the Benedum field area of Upton County, Slick-Urschel Oil Company's Arvilla E. Gordon 1-B has had a good show of oil in the Fusselman formation of the Silurian series. The test is located about 1¼ miles northwest of the field's discovery, Alford No. 1, and one mile south of Republic Oil's Silurian discovery for the field. On a drill stem test at 10,910-990 feet in the Fusselman it flowed at an estimated rate of 10 to 20 barrels of fluid per hour, mostly clean oil. Operators are continuing to drill ahead below 11,052 feet.

Elk City Play Heightened

As development continues in the year-old Elk City gas-condensate field of Beckham County, Oklahoma, early appraisals of the indicated structure are undergoing considerable upward revision. Since Shell Oil Company discovered this rich condensate field in late 1947, one other completion has been made. That being a 164-barrel producer drilled by Union Producing Company in November of this year and which was over two miles from the discovery well. Two others now working have definitely proved to be producers, but not yet officially tested. One of these is Shell's Long 1, one mile west of the discovery, and in which operators found four producing zones and is currently checking a possible fifth. The other is Union's Music 1-A, a test about 1½ miles southeast of the discovery, in which casing is about to be run for production tests.

Summary of Results of Exploratory Drilling

ITEM	Nov., 1948	Oct., 1948	ELEVEN MONTHS Jan.-Nov. 1948	1947	Percent Diff.
Oil Discoveries	68	82	803	643	+ 24.9
New Fields	52	56	547	380	+ 43.9
New Pays	16	26	256	263	— 2.7
Distillate Discoveries	12	11	97	92	+ 5.4
New Fields	11	7	61	43	+ 41.9
New Pays	1	4	36	49	— 26.5
Gas Discoveries	8	8	125	107	+ 16.8
New Fields	6	5	90	81	+ 11.1
New Pays	2	3	35	26	+ 34.6
Total Discoveries	88	101	1,025	842	+ 21.7
Extensions to Fields	12	30	194	175	+ 10.9
Oil Fields	8	26	155	134	+ 15.7
Distillate Fields	2	2	16	15	+ 6.7
Gas Fields	2	2	23	26	— 11.5
Total Prod. Tests	100	131	1,219	1,017	+ 19.9
Dry Holes	467	526	4,966	4,008	+ 23.9
Wildcats	462	514	4,897	3,894	+ 25.8
New Pays	.....	1	11	49	— 77.6
Outposts	5	11	58	65	— 10.8
Total Expl'tory Tests	567	657	6,185	5,025	+ 23.1
Percent Productive	17.6	19.9	19.7	20.2	.....
Percent Dry	82.4	80.1	80.3	79.8	.....

Two Finds in Rocky Mountains

The new gas-condensate discovery on the Dove Creek structure in Montezuma County, Colorado, made by Western Natural Gas Company and Byrd-Frost, Inc., has been rated at 265 barrels of 68-gravity per day through a ¼-inch choke. The test is the Anna Driscoll 1, in Section 3-38n-19w.

A step out well on the eastern flank of the Hatfield Dome field in Carbon County, Wyoming, is showing for a new pay zone in the Nugget sand. Ohio Oil Company's Union Pacific 4, is the prospective discovery and had the top of the Nugget at 4328. On a one-hour packer test, 540 feet of 35-gravity oil was recovered.

Results of Exploratory Drilling in November and First 11 Months, 1948-1947, by Districts

State or District	MONTH OF NOVEMBER, 1948														FIRST ELEVEN MONTHS, 1948																	
	Productive Tests									Total Productive	Unproductive Tests			Total Exploratory Tests	Productive Tests									Total Productive		Unproductive Tests				Total Dry		Total Exploratory Tests	
	New Fields			New Pays			Extensions								New Fields			New Pays			Extensions											
	Oil	Dis.	Gas	Oil	Dis.	Gas	Oil	Dis.	Gas		Wildcats	New Pays	Outposts		Oil	Dis.	Gas	Oil	Dis.	Gas	Oil	Dis.	Gas	11 Mo. 1948	11 Mo. 1947	Wildcats	New Pays	Outposts	11 Mo. 1948	11 Mo. 1947	11 Mo. 1948	11 Mo. 1947
Alabama											2			2												19			19	20	19	20
Arizona																										1			1		1	
Arkansas	1									1	9			10	7			1						8	11	98			98	63	106	74
California							3			3	14			17	15		1	7			25	1	1	50	31	187	1		188	243	238	274
Colorado											1			1	2		1	1					2	6	6	46			46	40	52	46
Florida											1			1	1									1		22			22	26	23	26
Georgia																										3			3	4	3	4
Illinois	1			1			2			4	48			52	23			24		1	40			88	135	495			495	404	583	539
Indiana	2									2	28			30	28		1	4			7			40	22	241			241	124	281	146
Kansas	4		1	1			1			7	38			45	62		6	3			4			75	65	431	1		432	317	507	382
Kentucky	1									1	3			4	5		1	1			1			8	8	49			49	53	57	61
Louisiana	6	2		2						10	30			40	21	18	7	40	14	2	4	4	3	113	80	224		1	225	259	338	339
North Louisiana											17			17	7	3	4	2	1		3	2	1	23	16	121			121	176	144	192
South Louisiana	6	2		2						10	13			23	14	15	3	38	13	2	1	2	2	90	64	103		1	104	83	194	147
Maryland																										1			1		1	
Michigan	2									2	21			23	11		4	2			3			20	20	223			223	215	243	235
Mississippi	1									1	14			15	3	1					2	1		7	9	103		2	105	83	112	92
Missouri											1			1												21			21	17	21	17
Montana											7			7	3			1			1			5	5	32		1	33	17	38	22
Nebraska																														2		2
New Mexico	2									2	6			8	9	1	2	5		1				18	9	74			74	60	92	69
North Carolina																														1		1
Ohio									1	1	3			4	1			1			1		9	12	11	36			36	42	48	53
Oklahoma	5	1		1						7	24			31	57	3	16	23		1	4			104	97	408		2	410	491	514	588
Oregon																														1		1
Pennsylvania																										4			4	5	4	5
South Dakota																										1			1		1	
Tennessee	1									1	6			7	2									2		35			35	15	37	15
Texas	25	8	5	9	1	2	2	2	1	55	194		5	254	281	38	39	129	22	30	59	9	8	615	484	2052	8	50	2110	1448	2725	1932
Dist. 1 S. Central	3									3	12			15	8			1		1				10	14	172		1	173	131	183	145
Dist. 2 Middle Gulf		3	1			1		2		7	12		2	21	12	9	7	16	8	7	4	6	1	70	60	161	1	9	171	109	241	169
Dist. 3 Upper Gulf	2	2		4	1		1			10	26			36	17	11	4	51	6	10	8	2	4	113	78	244	3	4	251	169	364	247
Dist. 4 L. Gulf-SW	2		2	2		1			1	8	29		2	39	26	12	7	22	8	12	6	1	2	96	106	292	1	22	315	244	411	350
Dist. 5 E. Central											7			7	4			2			1			7	11	82			82	69	89	80
Dist. 6 Northeast			1							1	6			7	6	3	1	5			5			20	15	59	2		61	53	81	68
Dist. 7-B N. Central	3	1		2						6	40			46	83	1	12	16			5			117	66	388		1	389	225	506	291
Dist. 7-C W. Cent.	1									1	10			11	17		1	2			2			22	24	83		1	84	39	106	63
Dist. 8 West	4		1				1			6	15		1	22	54		5	4			17		1	81	55	162	1	8	171	128	252	183
Dist. 9 North	9	2		1						12	36			48	53	2	1	10			11			77	53	403		4	407	260	484	313
Dist. 10 Panhandle	1									1	1			2	1		1							2	2	6			6	21	8	23
Utah	1									1				1	2		3							5		13			13	4	18	4
Virginia																	1							1							1	
Washington																										2			2	2	2	2
West Virginia																	4							4	3	4			4	7	8	10
Wyoming				2						2	12			14	14		3	15			4	1		37	21	72	1	2	75	45	112	66
Total U. S.	52	11	6	16	1	2	8	2	2	100	462		5	567	547	61	90	256	36	35	155	16	23	1219	1017	4897	11	58	4966	4008	6185	5025

MODERN EQUIPMENT

TRAINED CREWS

EXPERT INTERPRETATION

. . . to get the information you want

Accurate, comprehensive results in seismic exploration do not just happen . . . they are obtained from modern equipment manned by highly trained crews and expert interpretation that comes only through experience.

McCollum Exploration has been a leader in seismic exploration for over 25 years.

McCOLLUM EXPLORATION CO.

DOMESTIC AND FOREIGN EXPLORATION

Pioneers in

REFRACTION SHOOTING • REFLECTION SHOOTING

WELL SHOOTING • MARINE SHOOTING

McCOLLUM SINCE 1923

Exploration Company

853 ESPERSON BUILDING • HOUSTON 2, TEXAS

New Oil, Distillate and Gas Fields and New Pay Horizons Discovered in the United States in November, 1948

Also Important Extensions to Established Fields

COUNTY	FIELD	COMPANY, WELL AND LOCATION	Date Completed	Total Depth (Feet)	Completion Horizon (Feet)	[1]Name, Character and Age of Producing Formation	[2]Initial Production Method and Choke	Gravity of Oil
		ARKANSAS—New Oil Fields						
Ashley	Felsenthal	Superior Oil Co's Bradley Lbr. Co. 1, 660 fr nl 400 fr el 11-19s-10w, 3 mi e, 1 mi n Felsenthal.	11-15-48	6170	5847- 5880	Cotton Valley sd; Jur	P 53	22.8
		CALIFORNIA—Oil Field Extensions						
Kern	Kern Bluff	Gene Reid Exploration Co's Muir 1, Sect. 18-29s-29e, ½ mi se extension	11- 3-48	1184	1155- 1184	Sta. Margarita sd; Mio	P 50	14.0
Monterey	San Ardo	Texas Co's Orradre Two, H-4-13, Sect. 13-23s-10e, 1 mi se extension	11- 9-48	3034	2137- 2153	Sta. Margarita sd; Mio	P 25	....
Santa Barbara	Santa Maria	Yellowstone Oil Co's Capital 1, 990 s, 330 w fr c Sect. 30-10n-33w	10-20-48	4850	.....	Monterey sd; Mio	P 75	12
		ILLINOIS—New Oil Field						
Richland	Stringtown, E.	Calvert & Willis & Aurora's H. Schneider 1, nw nw nw 4-4n-14w, 1¾ mi e Stringtown fld.	11- 9-48	3017	3010- 3014	McClosky li; Miss	P 64; 3 wtr	....
		ILLINOIS—New Oil Pay						
Clinton	Shattus	Talbot Oil Co's L. C. Gullick 1-T, s se ne 28-2n-1w	11- 9-48	4071	4007-	Trenton li; Ord	P 50; 40 wtr	....
		ILLINOIS—Oil Field Extension						
Gallatin	Inman, E.	D. Miller Drlg. Co's C. Johnson 1, nw sw sw 22-8s-10e, ¾ mi s extension	11-16-48	1998	1986- 1993	Waltersburg sd; Miss	P 53; 42 wtr	....
Hamilton	Bungay Cons.	V. J. Nolan's Reed-Twist 1, (OWWO) se se se 4-4s-7e, 1¼ mi nw extension	11- 9-48	3507	3396- 3404	Rosiclare li; Miss	P 18; 24 wtr	....
		INDIANA—New Oil Fields						
Posey	.....	Coy Oil Co's P & A Lynch 1, nw se ne 27-7s-15w	11-12-48	2470	.....	Cypress sd; U Miss	P 60	....
Spencer	.....	R. Hal Compton's Robt. Montgomery Hrs. 1, 330 fr sl 1551 fr el se nw 31-7s-7w.	11-19-48	1709	1702- 1709	McClosky sd; L Miss	P 35	....
		KANSAS—New Oil Fields						
Butler	.....	Shawver-Graham, Inc.'s Guyot 1, ne ne se 5-29s-5e, 3 mi w Fox-Brush pl.	11-10-48	2804	2795- 2804	Bartlestvlle sd; Penn	P 30; 10 wtr	....
Cowley	.....	Wolf Creek Drlg Co et al's Bynum 1, sw sw se 18-32s-6e, 1 mi n Turner pl.	11-30-48	2292	2286- 2292	Layton sd; Penn	P 15	....
Ellis	Weigel	J. M. Huber Corp et al's Weigel 1, nw nw se 19-12s-16w, 2½ mi sw Canyons pl.	11-23-48	3662	3368- 3376	Lansing-KC li; Penn	P 16	....
Rooks	Nettie	Phillips Pet & Cities Service's Nettie 1, se se sw 34-9s-17w, 5 mi sw Westhusin pl.	11-30-48	3545	3243- 3268	Lansing-KC li; Penn	P 168; 510 wtr	....
		KANSAS—New Oil Pay						
Ellis	Burnett, SW.	Harvey H. Blair's Opdycke 5, (OWWO), se sw se 15-11s-18w	10-30-48	3485	3074- 3081	Topeka li; Penn	P 345	....
		KANSAS—Oil Field Extension						
Harvey	Hollow-Nikkel	Nat'l Coop Ref. Assoc's Schmidt 1, nw nw ne 31-22s-3w, ¾ mi s extension	11-16-48	3301	3265- 3275	Mississippi sd; Miss	P 50	....
		KANSAS—New Gas Field						
McPherson	.....	Hess et al's Coon 1, se se nw 23-19s-1w	11-30-48	2923	2910- 2923	Mississippi sd; Miss	1 mln	....
		KENTUCKY—New Oil Field						
McLean	Wyman	J. C. Miller & Ashland O&R Co's J. D. Bennett 1, nw sw sw 6-N-27, 15 mi sw Owensboro.	11-30-48	1994	1970- 1984	Cypress sd; U Miss	P 240	....
		SOUTH LOUISIANA—New Oil Fields						
Beauregard	Bivens, W.	Atlantic Refg. Co's Kirby Lbr. Co 1, 1956.6 s & 662,5 e of nwc Sect, 17-5s-13w, 3½ mi w Bivens fld.	11-25-48	9806	9328- 9334	.....	F 195; 1/8"	39
Beauregard	Bancroft, S.	Roeser & Pendleton, Inc. et al's Columbia Ld. & Timber Co 1, 1646.9 s 330 e of nwc Sect. 27-6s-13w.	11- 8-48	11090	10242-10252	.....	F 223; 1/4"	46.7
Calcasieu	.....	Union Oil Co of Calif.'s D. C. Powell 1, 1980 n 660 w of Sect 5-11s-9w, 1½ mi ne East Moss Lake fld.	11- 1-48	9303	8569- 8574	Miocene	F 97; 3/32"	35.3
Jeff Davis	.....	W. T. Burton's Anna Byam Keith 1, Sect 3-8s-3w, 1 mi sw Tepetate, W. fld.	11-16-48	9646	8392- 8406	Ortego sd; Mio	F 257; 5/32"	35.5
Jefferson	.....	Humble O&R Co's State-Caminada Pass 1-A, Lse Acct 4, Blk 16, Lse 799, Tr, 1114 Grand Isle Area, 5½ mi in Gulf of Mexico.	11-28-48	8259	4584- 4596	.....	F 219; 5/32"	38
Iberville	"Sunshine"	Sohio Pet Co's Harry B. Nelson 1-B, 1175 fr wl 1500 fr nl Sect. 14-9s-1e, 8 mi w-nw St. Gabriel fld.	11-12-48	11023	10310-10315	.....	F 60; 90 wtr; 1/4"	29.4
		SOUTH LOUISIANA—New Oil Pays						
E. Baton Rouge	University	T. G. Markley & Crosby Drlg Corp's Knox-Amiss-Community 3, Sect. 66-7s-1w.	10-29-48	9504	8186- 8194	Miocene	F 240; 3/64"	41.5
Terrebonne	Four Isle Dome	Superior Oil Co's LLE-State Unit 19-1, Sect 24-21s-16e, on se flk of dome	11-14-48	13230	12210-12220	Miocene	F 294; 3/64"	38
		SOUTH LOUISIANA—New Distillate Fields						
Iberia	.....	Magnolia Pet. Co's State Lse 838, 1, Blk 45, Eugene Island Area, 12 mi in Gulf of Mexico.	11- 7-48	13636	11351-11358	.....	F 60; 1.3 mln; 3/8"	45.4
St. Landry	.....	Sun Oil Co's Swift 1, 1563 n 1496 w of sec Sect 23-4s-7e, 2½ mi sw Melville twst.	11-18-48	12500	11240-11245	.....	F 190; 2.1 mln; 7/16"	54.8
		MICHIGAN—New Oil Fields						
Isabella	Isabella	Merrill Drilling Co's Fred J. Sheahan 1, se sw sw 7-15n-4w, 4 mi w Rosebush	11-26-48	3788	3782- 3788	Dundee dolo; Devo	F 172; 11/64"	46.7
Kent	.....	S. L. McCall's Townsend 1, nw sw sw 19-9n-10w, Courtland Twp	11-30-48	2261	2258- 2261	Traverse li; Devo	F 5	....
		MISSISSIPPI—New Oil Fields						
Franklin	.....	H. L. Hunt's W. L. Graves et al's 1, 1620 e 510 s of nwc Sect 29-6n-2e, 4 mi s & 2 mi e of Roxie.	11-30-48	10990	10578-10585	L. Tuscaloosa sd; U Cre	F 553; 3.6 mln; 1/2"	50.1
		NEW MEXICO—New Oil Fields						
Eddy	.....	S. P. Yates' State 1-D, 330 fr s&el Sect 24-18s-27e	11-13-48	2097	1990- 2022	.....	F 50	36
Lea	.....	J. C. Clower's State 1, 1980 fr s&el Sect 16-21s-34e, 2¼ mi w Eunice, W. fld.	11- 8-48	3948	3945- 3948	Seven Rivers sd; Perm	F 218	29
		OHIO—Gas Field Extension						
Meigs	Stewart	B. H. Putman et al's M. A. Hall 1, ne sw lot 10, Olive Twp	11-19-48	2029	2017- 2021	Berea sd; Miss	0.2 mln	....
		OKLAHOMA—New Oil Fields						
Grady	Bradley, NE.	Gulf et al's Mainka 1, nw nw ne 12-5n-5w	11-30-48	13250	13137-13250	Tulip Creek sd; Ord	F 464; 10 mln; 11/64"	46.5
Lincoln	.....	J. F. Smith's Jones 1, (OWDD) nw nw se 35-12n-3e	11-26-48	5609	4937- 4947	.....	P 72	....
Okfuskee	.....	Mohawk Drlg. Co. et al's Foster 1, se sw nw 14-10n-9e	11-30-48	3290	3026- 3062	Gilcrease sd; Penn	P 20	33.8
Payne	.....	Callery & Hurt's Blumer et al 1, se nw se 28-18n-2e	11-18-48	4372	4323- 4335	Skinner sd; Penn	P 2	....
Seminole	.....	B. B. Blair's Madgett 1, nw sw ne 4-10n-6e, w of Keokuk fld.	11-25-48	4275	4265- 4275	Misener sd; Miss	F 84; 1/4"	38
		OKLAHOMA—New Oil Pay						
Oklahoma	Jones	Anderson-Carey & Russell Maguire's Hanson 1, ne ne se 5-12n-1e	11-11-48	5754	5725- 5745	Misener sd; Miss	P 16	41.6
		OKLAHOMA—New Distillate Field						
Garvin	.....	Carter Oil Co's Yeary-Vaughn 1, c se nw 9-1n-1w	11-18-48	7650	4775- 4810	Hoxbar sd; Penn	F 36; 6 mln; 1/8"	61
		TENNESSEE—New Oil Field						
Pickett	Groce	Talbot & Mitchell, Ben Groce 1, c s½ se nw Sect 6, A-54-E, 1¼ mi n-nw Moodyville.	10- -48	793	611- 793	Trenton li; Ord	P 26	....
		TEXAS—District 1 (SOUTH CENTRAL)—New Oil Fields						
Edwards	.....	V. J. Meyer's Billy Holland 1, 2310 fr s&el of Sect. 35, HE&WT Sur, 23 mi w Rock Springs.	10-15-48	1166	476- 541	.....	P 5	18
Frio	.....	Lewis Oil Co's Oppenheimer & Lang B-1, 1320 fr el 330 fr sl J. A. Pranglin Sur 10, 3½ mi sw Charlotte fld.	11- 6-48	5588	5570- 5588	Navarro sd; U Cre	F 10; 3/16"	40.1
McMullen	"San Miguel"	Atlantic Refg. Co & Newman Bros. et al's Louis M. Gubbels 1, 476 fr n&wl G. H. Smith Sur, 11 mi n-ne Tilden.	11- 4-48	5425	5421- 5425	L Wilcox sd; Eoc	F 84; 5/32"	35.4
		TEXAS—District 2 (MIDDLE GULF COAST)—New Distillate Fields						
Bee	.....	Rudco O&G Co & Rock Hill Oil Co's C. P. Sparkman 2, 467 fr ne&swl Asa Walker Sur, 1 mi ne Mineral.	11- 7-48	7608	7554- 7562	Massive Wilcox sd; Eoc	F 1000; 20 mln; open	54
DeWitt	.....	Western Natural Gas Co's Ed. Zengerlie et al 1, 231 fr swl 1350 fr nwl of 100-ac lse, James Quinn Sur, 3 mi se Arneckville.	11- 5-48	8702	8158- 8168	.....	F 95; 3 mln; 1/4"	....
Live Oak	.....	Magnolia Pet Co's Maxine Means 1, 660 fr n&wl of ne¼ Sect 90, Simmons Farm Trs. ACH&B Sur, 3½ mi e San Caja fld.	11-20 48	9022	8820- 8825	.....	F 136; 5 mln	51.5
		TEXAS—District 2 (MIDDLE GULF COAST) Distillate Field Ext.						
Calhoun	Long Mott	Houston Oil Co's Clarks & Whitaker 1, 800 fr swl 340 fr nwl Mathew Dockery Sur. ½ mi n-nw extension.	10-25-48	10039	9765- 9777	.....	F 41; 0.6 mln; 1/8"	55.6
Goliad	Melrose	H. R. Smith & W. C. McBride, Inc's Carl Weise 1, R. E. Handy Sur. 1½ mi ne extension.	11-24-48	8295	7843- 7858	Slick sd; Eoc	F 156; 2.5 mln; 1/8"	65
		TEXAS—District 2 (MIDDLE GULF COAST)—New Gas Field						
Victoria	.....	Fidelity O & Rylty Co's W. H. Reeves 1, 1320 fr nel 330 fr sel of 510.28-ac lse, J. M. Cobarrubias Gr. sw of Ccletto Cr. fld.	11-10-48	5627	4010- 4020	Frio sd; Olig	64 mln; open	....
		TEXAS—District 2 (MIDDLE GULF COAST)—New Gas Pay						
Jackson	Little Kentucky	W. L. Pickens' John Dramer 3, 75-ac lse, Morris & Cummings Sur 34	11-19-48	6017	5792- 5798	.....	0.5 mln; 3/64"	....
		TEXAS—District 3 (UPPER GULF COAST)—New Oil Fields						
Jasper	"Buna"	Placid Oil Co's J. S. Richardson Hrs. 1, 820 fr wl 1510 fr nl, Wm. Weiss Sur, 3½ mi w Bessmay.	11- 4-48	8350	7459- 7469	Yegua sd; Eoc	F 154; 5/32"	45
Liberty	"S. Dayton"	Gulf Oil Corp's Sidney A. Smith et al 1, 565.5 fr sl 330 fr nl 209-ac lse, Wm. D. Smith Sur.	11- 6-48	9936	8562- 8600	Yegua sd; Eoc	F 254; 3/64"	38.9

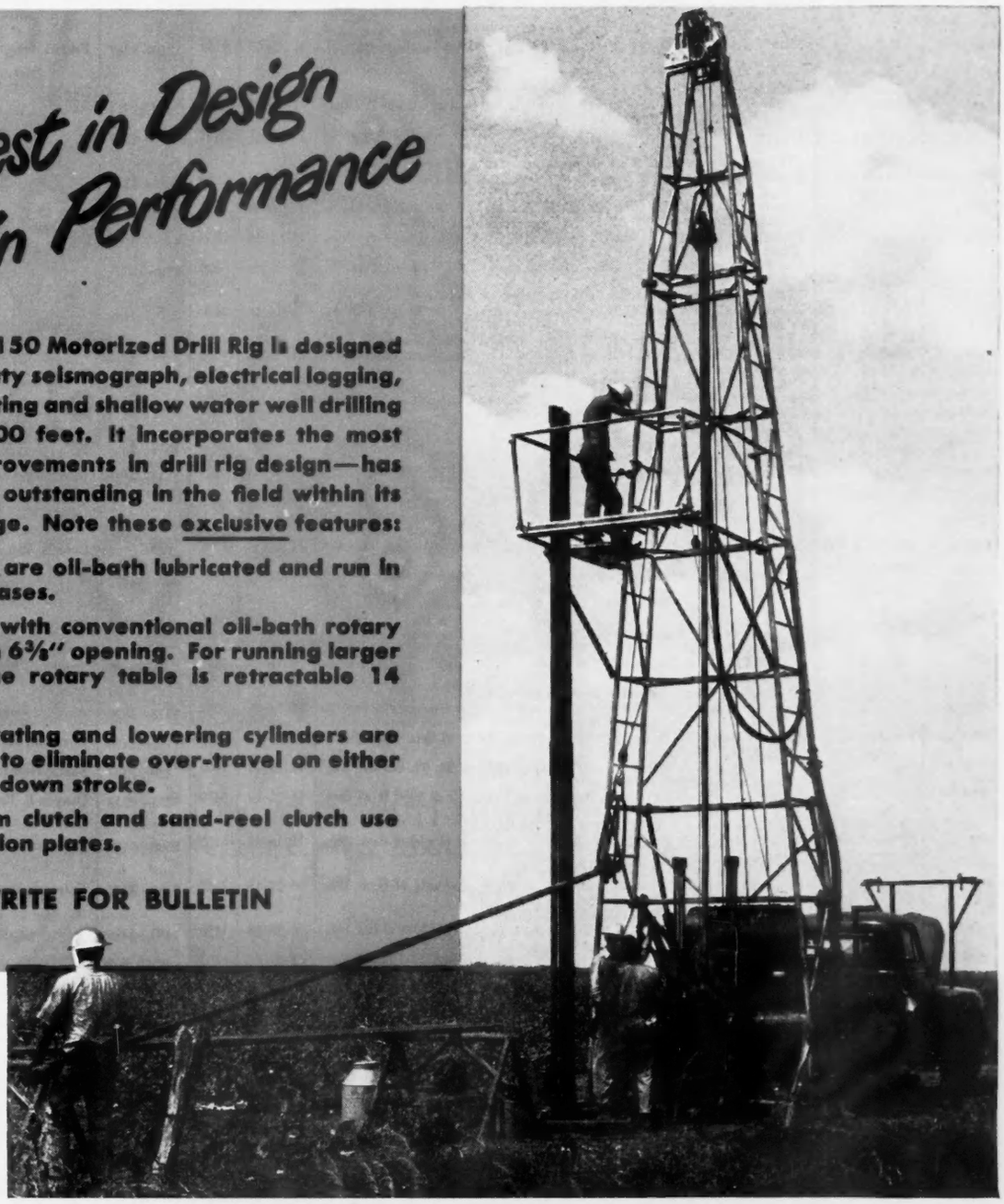
NEW! The JOY #150 MOTORIZED DRILL RIG

Latest in Design First in Performance

JOY'S new #150 Motorized Drill Rig is designed for heavy-duty seismograph, electrical logging, structure testing and shallow water well drilling down to 1500 feet. It incorporates the most modern improvements in drill rig design—has proved itself outstanding in the field within its capacity range. Note these exclusive features:

- ★ **All chains are oil-bath lubricated and run in oil-tight cases.**
- ★ **Equipped with conventional oil-bath rotary table with 6¾" opening. For running larger casing, the rotary table is retractable 14 inches.**
- ★ **Mast elevating and lowering cylinders are arranged to eliminate over-travel on either the up or down stroke.**
- ★ **Main drum clutch and sand-reel clutch use same friction plates.**

WRITE FOR BULLETIN



Consult a Joy Engineer

The efficient and highly portable #150 Motorized Drill Rig on the job.

W&D 02195

JOY MANUFACTURING COMPANY

GENERAL OFFICES: HENRY W. OLIVER BUILDING · PITTSBURGH 22, PA.

IN CANADA: JOY MANUFACTURING COMPANY (CANADA) LIMITED, GALT, ONTARIO

New Oil, Distillate and Gas Fields and New Pay Horizons Discovered in the United States in November, 1948—*Continued*

Also Important Extensions to Established Fields

COUNTY	FIELD	COMPANY, WELL AND LOCATION	Date Completed	Total Depth (Feet)	Completion Horizon (Feet)	[1]Name, Character and Age of Producing Formation	[2]Initial Production Method and Choke	Gravity of Oil
		TEXAS—District 3 (UPPER GULF COAST)—New Oil Pays						
Brazoria	Stratton Ridge	E. Cockrell's Seaburn Heirs II, 2757-ac lse, J. E. Groce Sur	11-10-48	4142	4131- 4142		F 72; 7/64"	26
Harris	Durkee, N.	Union Prod. Co's Langtry et al 1, (OWWO) 251-ac tr. WCRR Sur, Sect 21, Blk 4.	11- 3-48	7610	7085- 7090		F 140; 3/64"	35.6
Jefferson	Stowell	Texas Co's Koch-Jenkins Unit 1, (OWWO) 40-ac unit	11-29-48	7840	7238- 7248	"C" sd; Olig	F 174; 3/64"	34.6
Liberty	Hankamer	R. Olsen Oil Co's Ezzell A-4, (OWWO) 70-ac lse, Levi Barrow Sur	10-10-48	4742	2692- 2702		P 37	21
		TEXAS—District 3 (UPPER GULF COAST)—Oil Field Extensions						
Brazoria	Chocolate Bayou	Stanolind O&G Co's Edward S. Boyles 1, 26-acs of 66-ac lse, S. F. Austin 1 ¾ Lge., 3100 ft sw extension.	11-16-48	12004	11537-11549		F 32; 215 wtr; 1/4"	40.4
		TEXAS—District 3 (UPPER GULF COAST)—New Distillate Field						
Harris		F. M. Corzelius' H. H. Rath 2, 2338 fr nl 999 fr el of W. Sevey Sur. 1 mi nw Aldine.	11-29-48	7773	7361- 7365		F 72; 3.5 mln; 1/4"	59.6
Tyler	E. Hillister	Humble O&R Co's Wm. Rice Institute 1, 1700 fr nl 2000 fr n'ly wl of tr., Arthur Hutchins Sur. 8 mi ne Warren Twst.	11- 4-48	10000	8260- 8270		F 78; 2.1 mln; 1/16"	59
		TEXAS—District 3 (UPPER GULF COAST)—New Distillate Pay						
Brazoria	Danbury Dome, SW Flank	Humble O&R Co's John Chowanec, Jr. 1, Henry Austin Lge 5, ¾ mi s oil prod.	11- 3-48	9139	8310- 8387	Frio sd; Olig	F 13; 1 mln; 1/4"	56.2
		TEXAS—District 4 (LOWER GULF-SW.)—New Oil Fields						
Aransas	"Salt Lake"	Atlantic Refg. Co's V. G. Gwynn 1, 1980 fr nl 660 fr el of 1078-ac lse, Jos. Hollis Sur, 3 mi nw Rockport.	11-16-48	10000	7209- 7214		F 41; 3/64"	41.6
Starr	"Semmes"	Coastal Refineries, Inc. & W. D. Kennard's D. R. Semmes 1, 330 fr s&wl of 2700-ac lse, Porc. 88, 2¼ mi se Ricaby S. fld.	10-26-48	3033	2466- 2467		F 14; 3/32"	
		TEXAS—District 4 (LOWER GULF-SW.)—New Oil Pays						
San Patricio	Morgan	Southern Minerals Corp's W. Foster 1, 330 fr el 467 fr sl Lot 5, Geo Merris Sur., 1 mi nw extension.	11- 4-48	6958	5383- 5388		F 80; 1/4"	34.5
Starr	Borosa	Sunray Oil Corp's T. B. Slick Est. B-1, 320-ac lse "B", Sur 267	11- 2-48	4522	4465- 4475		F 159; 5/32"	49.4
		TEXAS—District 4 (LOWER GULF-SW.)—New Gas Field						
Starr		Continental Oil Co's Dee Davenport 5, 2310 fr el 1950 fr sl Gregorio Jiminez Sur., 1½ mi e Rincon fld.	11- 1-48	6005	4245- 4266		14 mln; open	
Starr		Sun Oil Co's Sustin Est. 1, 1400 fr el 1450 fr nl of 852.57-ac lse, Porc. 38 & 39, 3 mi n Coastal fld.	11- 6-48	5800	3724- 3736		9 mln; open	
		TEXAS—District 4 (LOWER GULF-SW.)—New Gas Pay						
Kenedy	Sarita	Humble O&R Co's John G. Kenedy Jr. B-5, (Relief Well for No. 4 Blowout), El Paistle Gr.	10-28-48	2420	2278- 2288		8.2 mln; open	
		TEXAS—District 4 (LOWER GULF-SW.)—Gas Field Extension						
Nueces	Auga Dulce	Skelly Oil Co et al's Richard King B-1, Sect 49 of King Farm Lots, ⅜ mi n-nw extension.	11- 3-48	7002	5482- 5512		0.9 mln; open	
		TEXAS—District 6 (NORTHEAST)—New Gas Field						
Nacogdoches		Arkansas Fuel Oil Co's Sarah B. Adams et al 1, 562 fr nwl 467 fr nel of 105.7-ac Tr., Harrison Graham Sur. 2 mi e Garrison.	11-17-48	7861	7109- 7119	Pettit sd; L Cre	1.3 mln; open	
		TEXAS—District 7-B (NORTH CENTRAL)—New Oil Fields						
Callahan		L. J. Snyder's L. J. Gorsuch 1, (OWWO), 200 fr n&el Sect. 1, Blk D, SPRR Sur. 5 mi n Clyde.	10-31-48	1533	1519- 1523		P 7; 3 wtr	
Shackelford		McElroy Ranch Co's Pitman & Reynolds 1, 330 fr nl 3276 fr el Sect 2, Blk 11, T&PRR Sur., 7 mi e Albany.	10-10-48	4538	4533- 4538	Ellenburger dolo; Ord	F 768; 1/4"	43.5
Taylor		Sojourner Drlg. Co's D. O. Huddleston "A" 1, 330 fr n&wl Lot 4, Lge. 146 Grimes CSL Sur, 2½ mi s Merkel.	11- 1-48	2835			F 470; 3/4"	38
		TEXAS—District 7-B (NORTH CENTRAL) New Oil Pays						
Jones	Jones Co. Reg.	Max Eversberg Jr. & B. C. McMordie et al's J. H. Commons 1, 330 fr e&sl of Lot 7, Blk 4, A. W. Hill Sur.	11- 8-48	1794	1787- 1794	Cook li; Penn	P 50	38.3
Throckmorton		J. H. Snowden et al's Mrs. F. Marrs 1, (OWWO) 1500 fr el 950 fr sl Sect. 289, BBB&CRR Sur, 1½ mi se Throckmorton.	11-21-48	4852	4624- 4630		F 119	39.4
		TEXAS—District 7-B (NORTH CENTRAL)—New Distillate Field						
Wise		Signal O&G Co & T. W. & J. M. Loffland Jr's Dr. Jack Daly 1, 660 fr sl 1960 fr wl J. F. Williamson Sur, Sect 48, 3 mi s Cottondale.	11-10-48	6819	6505- 6565	Ellenburger sd; Ord	F 171; 4 mln	63.9
		TEXAS—District 7-C (WEST CENTRAL)—New Oil Field						
Coke	"Millican"	Sun Oil Co's P. W. Millican 1, 660 fr n&el Sect 230, Blk 2, H&TC Sur, 6 mi s Jameson, S. fld.	11-12-48	5971	5955- 5971	Strawn li; Penn	F 576; 1/4"	45.4
		TEXAS—District 8 (WEST)—New Oil Fields						
Dawson		Tide Water Assoc. Oil Co's Everett Turner 1, 660 fr n&el of s½ Sect 2, Blk C-39, PSL Sur, 2½ mi n Welch pl.	11-24-48	5061	4888- 4906	San Andres li; Perm	P 60; 29 wtr	30
Gaines	"N. Russell-Devonian"	Argo Oil Corp's E. H. Jones 1-N, 660 fr nl 1980 fr wl Sect 496, Blk G, CCSD&RGNG Sur, 10 mi sw Denver City.	11-16-48	11205	11125-11190	Devonian sd; Devo	Sw 690	41.6
Scurry		Magnolia Pet. Co's Winston Bros. 1, 330 fr n&wl of Tr. 72, Sur 37, Kirland & Fields Subd. 3½ mi sw Snyder.	11- 5-48	7905	7429- 7441	Pennsylvanian sd; Penn	P 67; 28 wtr	33.4
Scurry		Standard of Texas' Mrs. Jessie Brown et al 1, 1880 fr nl 1980 fr wl Sect 440, Blk 96, H&TC Sur. 8½ mi n of Snyder.	11-21-48	6419	6333- 6358	Canyon li; Penn	F 532; 1/4"	45.5
		TEXAS—District 8 (WEST)—Oil Field Extension						
Gaines	Seminole, W	Atlantic Refg. Co's J. H. Proctor 1, 660 fr nl 1980 fr el n½ of Sect. 365, Blk G, CCSD&RGNG Sur, ¾ mi extension.	11-19-48	5185	5080- 5185	San Andres li; Penn	P 24; 94 wtr	29
		TEXAS—District 8 (WEST)—New Gas Field						
Gaines		Honolulu Oil Corp's Thos. S. Riley Est. 1, 660 fr s&el se¼ of Sect. 123, Blk G, WTRR Sur, 8 mi ne Seminole.	10-22-48	7542	3436- 3541	Yates sd; Perm	0.8 mln; open	
		TEXAS—District 9 (NORTH)—New Oil Fields						
Archer		T. B. Cochran et al's Mrs. J. H. Turbeville 1, 150 fr wl 1170 fr sl Blk 155, R. Carson Sur, 13 mi nw Archer City.	10-29-48	1489	1480- 1489		P 10	
Archer		W. G. Gouchie's A. W. Simmons 1, 950 fr el 450 fr sl, Lot 36, Blk 5, Clark & Plumb Sur, 4 mi e Archer City.	11-12-48	902	891- 902		P 49	37
Archer		Geo. W. Graham's L. F. Wilson "H" 1, 330 fr s&el Sect 20, H&TC Sur. 2 mi se Hull-Silk-Sikes fld.	11-12-48	5675	5192- 5212	Caddo li; Penn	P 35; 8 wtr	42
Archer		Timberlake & Kelleher's City of Wichita Falls 1, 625 fr sl 500 fr wl Blk 112, ATNCL Sur, 8 mi se Mankins.	11-29-48	1456	1449- 1456	Gunsight li; Penn	P 52	38
Montague		Continental Oil Co's L. M. Staley 1, 330 fr s&wl of n 230-ac of R. Crawford Sur, 3 mi nw Ringgeld.	11-21-48	6107	5970- 5980	Bend cgl; Penn	F 118; 10 wtr 1/4"	40
Montague		Russell Maguire's B. Stansall 1, 900 fr el 1700 fr nl Wm. Ainsworth Sur, Blk 70, 3¼ mi w Nocona.	11-30-48	5764	5385- 5405	Bend cgl; Penn	P 92	46
Montague		Russell Maguire's R. A. Stewart 1, 330 fr e&sl 55-ac lse, Blk 19, J. Y. Castello Sur, 5½ mi w Nocona.	11-14-48	5372	5352- 5358	Bend cgl; Penn	P 1104; 1/2"	43.9
Young	"Proffitt"	Humble O&R Co's W. D. Daws et al "B" 1, 1400 fr sl 482 fr wl Sect. 770, TE&L Sur., 1½ mi nw Holbert-Caddo fld.	11-16-48	5138	4361- 4371	L Caddo sd; Penn	P 57; 49 wtr	29
Young		Roy H. King et al's J. J. Henderson 1, 330 fr nwl 2640 fr swl J. A. Hill Sur, 1 mi n Herron City.	3-25-48	2463	2455- 2463		P 8	
		TEXAS—District 9 (NORTH)—New Oil Pay						
Wichita	KMA	Le Bus Oil Co's W. L. Hodges 1-A, (OWDD) 330 fr s&wl of lse, H. B. Balch Sur. 4½ mi ne Kamay.	11-27-48	4307	4250- 4307	Ellenburger dolo; Ord	F 936; 1/4"	41.6
		TEXAS—District 9 (NORTH)—New Distillate Fields						
Jack		Davon Oil Co's W. J. Dees 1, 400 fr ne&nwl Geo Taylor Sur, 4 mi n Jo[illegible]lin fld.	11-15-48	6490	4970- 4990		F 12; 1.5 mln; open	57
Jack		Jack Grace's T. H. Cherryhomes 1, 1800 fr el 330 fr nwl of lse, C. J. C. O'Conner Sur. 4 mi se Cundiff.	11-17-48	6720	5472- 5490	Bend cgl; Penn	F 312; 3.8 mln; 3/4"	67
		TEXAS—District 10 (PANHANDLE)—New Oil Fields						
Gray		L. A. Helms' A. H. Brown 1, Sect 15, Blk 30, H&GN Sur., 4 mi n McLean	11-18-48	2716	2616- 2716		P 25	
		UTAH—New Oil Field						
San Juan		Western Nat'l Gas & Byrd-Frost's English-Tribal 2, se nw 22-43s-22e, Boundry Butte Area.	11-15-48	1514	1490- 1510	Coconino sd; Perm	P 140	42.7
		WYOMING—New Oil Pays						
Albany	Rex Lake	Phillips Pet. Co's Coughlin 7, ne sw nw 26-16n-77w	11-26-48	6068	3926- 3935	Lakota sd; L Cre	Sw 312	
Park	Fourbear	Honolulu Oil Co's Anderson 3, (OWDD) sw nw se 20-48n-102w	11-24-48	3941	3502- 3626	Madison li; Miss	Sw 250	14

[1] Character of producing formations abbreviated thus: ch, chalk; dolo, dolomite; li, limestone; sd, sandstone; sh, shale; sur, serpentine; cgl, conglomerate. Ages of formations abbreviated thus: Plio, pliocene; Mio, Miocene; Olig, Oligocene; Eoc, Eocene; U. Cre, Upper Cretaceous; L. Cre, Lower Cretaceous; Jur, Jurassic; Tri, Triassic; Perm, Permian; Penn, Pennsylvanian; U. Miss, Upper Mississippian; L. Miss, Lower Mississippian; Devo, Devonian; Sil, Silurian; Ord, Ordovician; Cam, Cambrian.

[2] Barrels of oil per day (24 hr. rate), flowing (F), pumping (P), swabbing (Sw), or bailing (B); or million cubic feet of gas daily open flow capacity; size of choke given in inches.

Surface Recording Pressure Bomb and Fluid Sampler feature Testing Tool

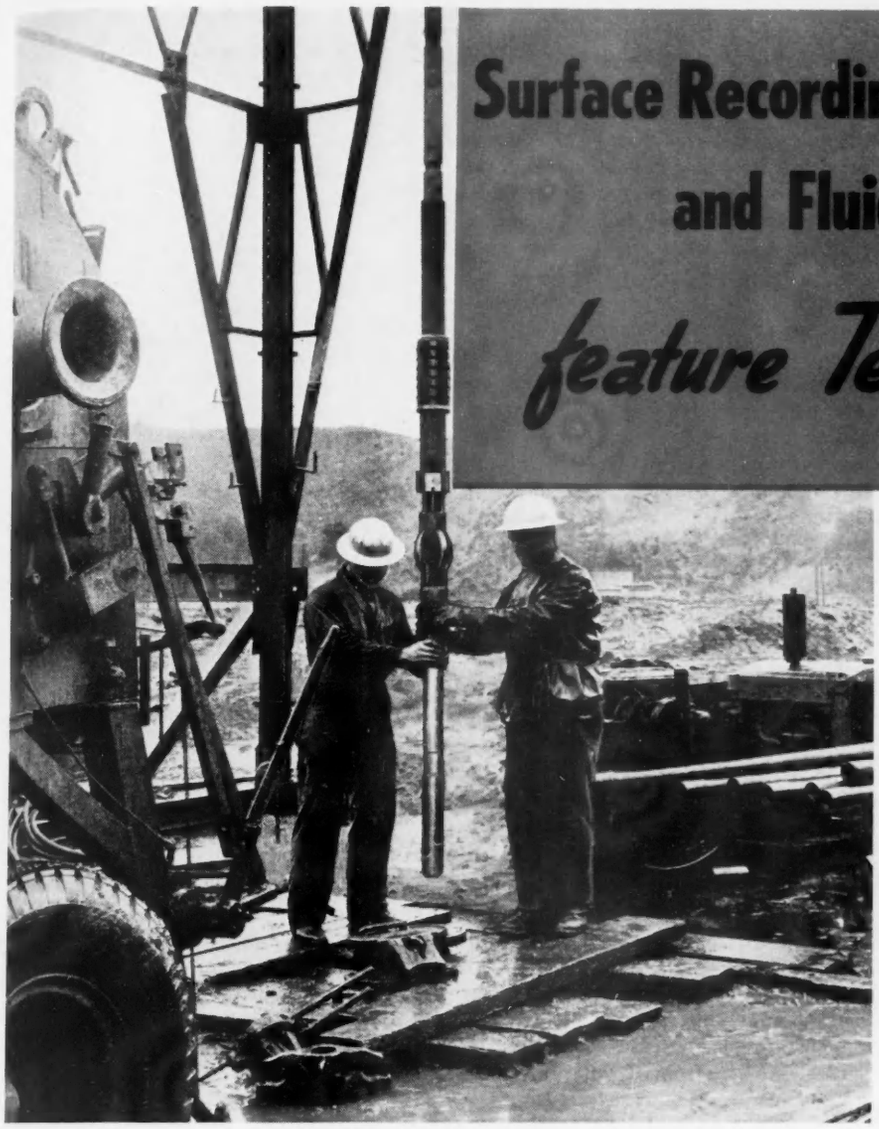


FIGURE 1. Gun perforator, pressure sensitive element and packer, made up as a complete unit, are screwed to the bottom joint of the operating string. The completely assembled unit at left is about to be lowered into the well. Electric conductor cable, to which are attached a sampling chamber and sinker bar, then is lowered inside the string to establish electrical contact with the tester element.

By W. C. (HUT) ERWIN
Manager, Western Division, McCullough Tool Company

DEVELOPMENT of an instrument which brings to the surface, during test, pressures being encountered down the hole at time of shooting or testing, greatly assists in elimination of "dry runs" and also enables the operator to check fluids while the tester is still in the hole. The author describes this combination, and cites examples of its effectiveness on deep tests.

SURFACE recording of bottom-hole pressures is now possible during water shut-off or production tests, as is also the procuring of actual samples of the fluid as many times as desired while the tester remains in the hole. This saves hours of rig time, preventing blowouts and assuring positive results on the first run.

This recent development, a bottom-hole pressure surface-recording instrument with which is combined a fluid sampling device, represents a major improvement in formation testing equipment in which the gun perforator and casing tester are combined.

The new tool is made up as a unit (Figure 1), then attached to the drill pipe or tubing string and lowered into the well. After the string is positioned and the packer set, the electric conductor cable with attached sampling chamber and sinker bar is lowered inside the string to where it makes contact with the testing tool.

Pressure bombs have been used for years below the packer in a well to record differentials in pressures, but it has always been necessary to wait until the pipe is pulled before results of the test are known. In many instances, after the pipe was pulled, it was found that the tester was plugged, necessitating a re-run. During re-runs the tester frequently would become plugged again. With the new surface recording instrument, plugging is instantly indicated on the chart. The operator in such instances simply releases the packer and the resulting pressure clears the testing tool immediately, eliminating re-runs and lost time.

Oil operators always have recognized the need of knowing what was going on down in the well during water shutoffs or production tests, and knowing it at the time it was happening. Because the

new recorder device is at the surface and visible at all times to the operator, timely warning is given of any unusual conditions existing or developing in the well. For example, the recorder indicates when the gun has fired, a fact heretofore not always determinable until the gun is pulled from the well. If formation pressures build up to a point where they might cause a blowout, the tester can be closed and the fluid dumped back on the formation, and when necessary, additional heavy mud can be pumped into the well. Similarly, the operator can watch the pressure curve build up and know exactly when the fluid level and formation conditions have become stabilized.

Many hours of rig time can be saved due to the fact that the surface recorder provides the operator with a complete record of the test and enables him to get the next operation under way immediately while the tester is being withdrawn from the well. Heretofore, the sub-surface recorder had to be brought to the surface and examined before any further progress could be made. An additional advantage is found in the large chart obtained and on which pressure differentials of as small as two pounds can be read.

A sample of the last fluid to come through the valve in the tester before the latter is closed is brought to the surface in an ingenious fluid sampler attached to the end of the electric conductor cable. Several samples may be secured during the test if desired, giving the operator an opportunity to test thoroughly the fluid before starting out of the hole with the testing tool.

Quite often, during a production test, where a conventional tester is being used, a quantity of mud, water, drilling fluid and emulsion will enter the operating string ahead of the oil and/or gas; and because of the predetermined time limit on the test, only a small amount of oil may find its way into the operating string before the tester is closed. When this occurs it becomes necessary to make an additional test to fully ascertain the productivity of the zone.

With the new combination of gun tester with fluid sampler and surface recording pressure bomb equipment, sufficient information is provided before the tester is pulled, enabling the operator to decide immediately whether or not to continue the test. By eliminating the need of additional runs to further test a partially tested zone, a great saving is effected.

Operation of Tester

The equipment is run as a unit and in the following manner:

The gun perforator and a pressure sensitive element, made up before the tool is delivered to the well, are screwed to the bottom joint of the operating string. They are joined to the bottom of the testing tool or packer in such a manner that the pressure sensitive element is exposed at all times to well pressures. An electric conductor element is so arranged through the tester as to connect with the pressure sensitive element at the bottom of the tester and provide continuity to the top sub above the tester. The assembly is then run into the well on an operating string of tubing or drill pipe to a point where the test is to be made. The sinker bar and fluid sampling device then are run in through the operating string on the electric conductor cable. The sinker bar is set down on a companion connection in the testing tool (Figure 2) and establishes continuity between the electric firing assembly in the gun perforator, the pressure sensitive element, and the electric operating and control instruments at the surface.

As soon as contact is made, the recording instrument at the surface (Figure 3) immediately indicates the hydrostatic pressure in the well. The gun perforator is fired in the usual manner from the shooting panel at the surface. The recorder instantly shows that the gun has been fired and continues to draw a curve of the hydrostatic head in the well.

After the gun is fired, the operating string is moved upward a few feet and the tester is set, excluding the original hydrostatic pressure from the bomb and exposing the bomb to the formation pressure below the packer.

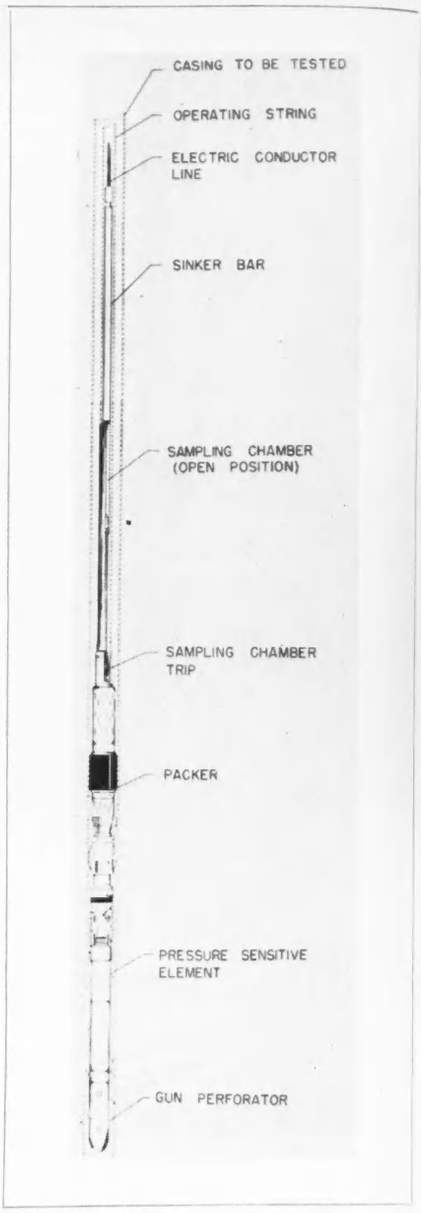


FIGURE 2. This is manner in which sinker bar sets down on companion connection in the testing tool, establishing electrical connection between tester element and surface recording equipment and controls. Sinker bar and sampling chamber are run in the operating string after testing tool has been set at desired depth.

The inlet valve in the tester then is opened. If the test is dry, there will be little or no change in pressure shown on the chart (Figure 4) at the surface, as time passes. If the test is wet, the surface recorder chart (Figure 5) will indicate a continuous increase in pressure until the column of fluid rises inside the operating string to a point where the pressure created by the fluid head equals the rock pressure and the column becomes static, or until the fluid flows over the top of the operating string.

When the test is completed, the inlet valve is closed and the sampling chamber is actuated by upward movement of the line, at which time a sample of the lowermost fluid is trapped and brought

About the Author

W. C. (HUT) ERWIN has had more than 30 years of diversified field experience with various producing companies and drilling contractors. In 1936 he became fishing service man for McCullough Tool Company, Los Angeles, for whom he is now western division general manager.

FIGURE 3. When the sinker bar and connector reaches the testing tool an electric connection is made, providing continuity from the gun perforator and pressure sensitive element below the testing tool, to the power supply and surface recorder.

to the surface. As many samples as desired may be obtained during the test.

Case Histories

The equipment has been in use for almost a year and in that time many interesting and unusual jobs have been successfully completed. The very first job was in a crooked hole. Although conditions were far from ideal, this water shutoff job took only five hours and 25 minutes. This included making up the tester, going in the hole, making a one-hour test, and pulling the string out of the hole.

A typical record obtained of a water shutoff test, graphically illustrating the ease with which a routine test is conducted, is shown in Figure 6.

In this instance the tester plugged three different times, but the operator was able to see what was happening and in each case the tester was immediately unplugged by the simple process of releasing the packer.

Line A shows the line being run into the hole where it made contact with the tester. Point B shows the waves and variations caused by movement of the entire assembly in the hole. When the operating string is moved as little as one foot up or down the hole, indication of the change in hydrostatic pressure is easily detected on the surface chart.

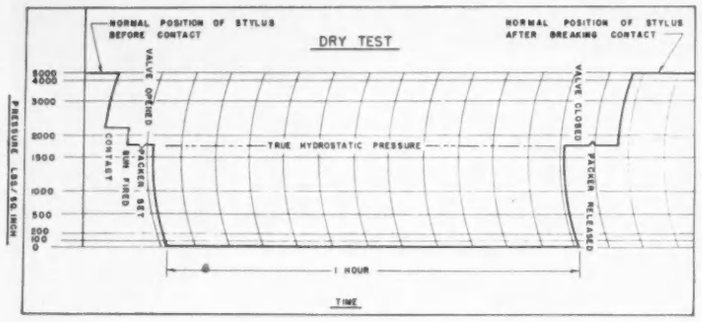
After the packer was set and the hydrostatic pressure excluded from the pressure sensitive element, the recorded pressure immediately dropped off to approximately 700 pounds. From point C the curve gradually rose with a few variations caused by intermittent plugging, the latter caused by entrance of pieces of shale or other material large enough to cause momentary stoppage of fluid.

Points D and E indicate that the tester valve was definitely plugged. This information was instantly recognized by the operator and the tester was picked up. This closed and reopened the valve, which resulted in successfully unplugging the tester valve. Point F indicates a partial plugging that cleared itself without aid.

From there on the test proceeded normally with a gradual increase in pressure to approximately 1300 pounds.

At point G it was decided to take a sample of the fluid entering the operating string. This was accomplished by pulling the sinker bar loose from the contact at the top of the tester. With the upward movement of the line a set of shear pins sheared allowing the telescoping sample chamber to open and admit a quantity of fluid. Upon continued upward movement of the line, the latch normally holding the sampling chamber down, was forced open, allowing the sampling chamber to be pulled from the hole.

In this instance the sample was fresh water and the natural assumption was that it came from the drilling fluid. Had a conventional tester and pressure bomb been employed on this job, and a like plugging condition existed, which probably would have been the case, because all tester valves are very similar and are equally apt to plug, the test probably would have been null and void because fluid entry would have stopped at the time of the plugging, and knowledge that the tool was plugged would not have been available until after the tester had been pulled from the well. A re-run of the tester would have been necessary. The same thing probably would have happened two or three times. On the other hand, had the tester not



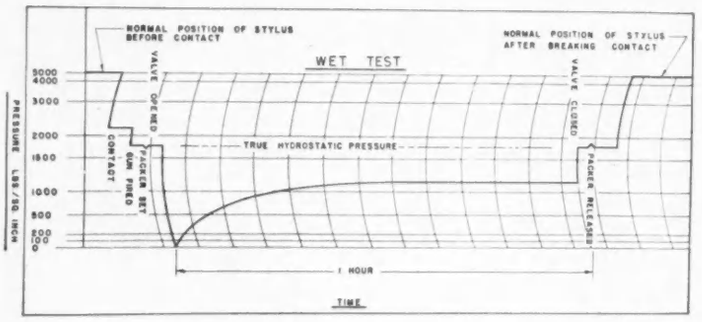


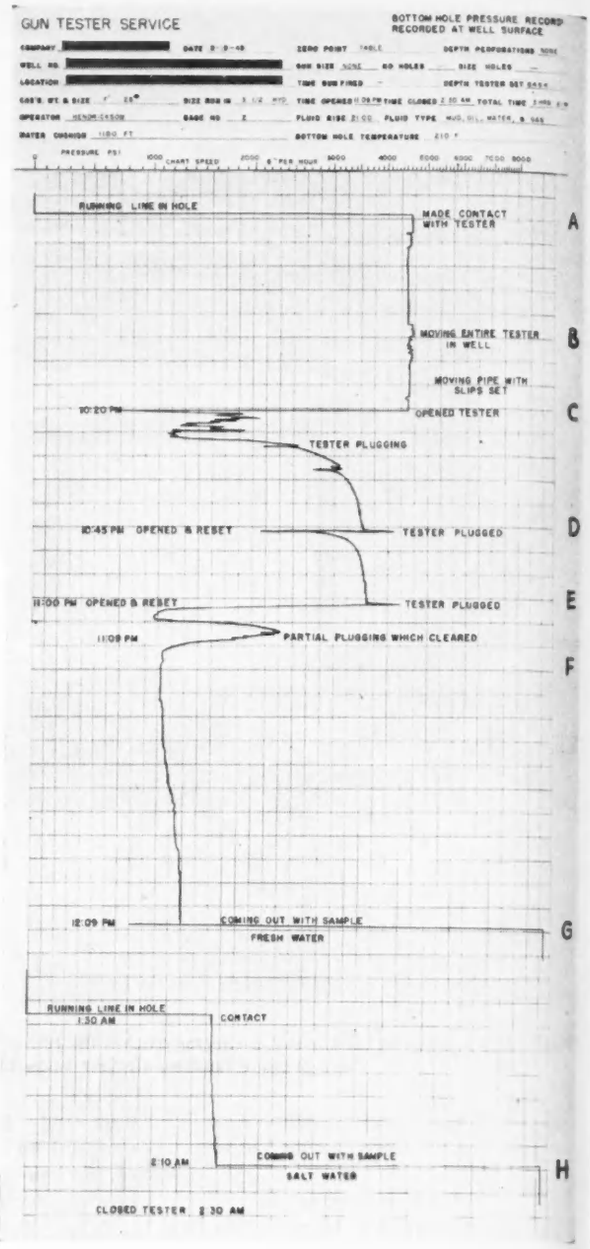
FIGURE 4. *(Top left)* **If the test is dry (above) there will be little or no indication of pressure and the chart will show a straight line throughout the duration of the test.**

☆

FIGURE 5. *(Lower left)* **When the gun is fired the information is instantly recorded on the chart (above) and the needle immediately returns to the hydrostatic pressure point. If the test is wet (as above) the curve will continue showing the increase of pressure as the fluid rises inside the operating string until the fluid head equals the formation pressure, becomes static or until the fluid flows over the top of the operating string, as the case may be.**

☆

FIGURE 6. *(Right)* **Exact duplicate of chart made by surface recorder on a water shutoff test. Note plugging and unplugging of tool. Also note two samples of fluid being taken by special sampling chamber while testing tool remains in the well.**



☆ ☆ ☆

plugged at all and the test terminated after two hours, the fluid in the operating string would have been found to be fresh water and the possible assumption could have been that the test was dry.

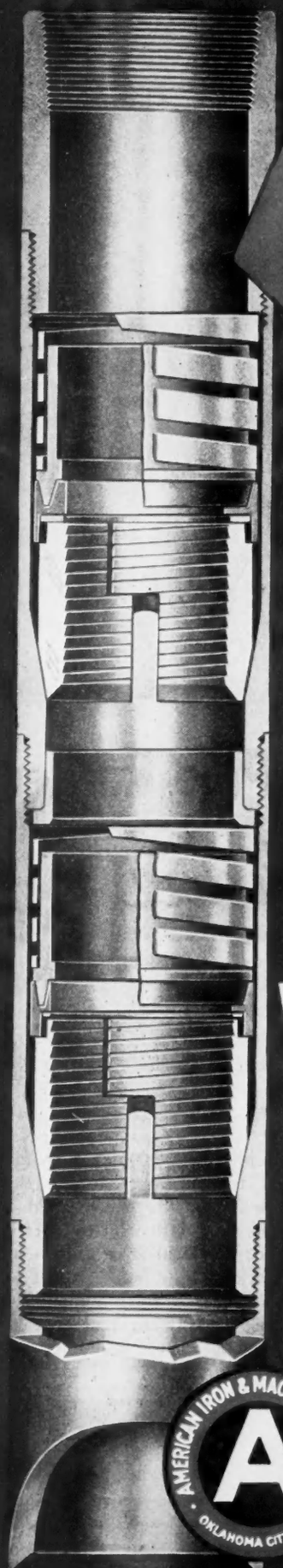
Because the sampling chamber was available, a re-run at point H was made to obtain a second sample while the test continued as indicated on the chart at this point. The second sample was salt water, which indicated that even though the testing continued over a period of two hours before the first sample of fresh water was obtained, it was necessary for the salt water to force the fresh water out of the formation before the salt water could enter the operating string and indicate a wet test, which it proved to be in this particular case.

An unusual test was made at 8000 feet when six 3½-inch, 30-shot guns were run on the tester and 180 holes shot simultaneously. The surface recorder indicated when the guns had been fired and drew a curve of the change in pressures as they occurred. The production from this test proved to be far greater than anticipated, so the entire zone was shot with 1332 holes in 12 hours.

On several jobs the double check of measurements, made possible by the fact that the electric conductor cable is run in over an odometer, proved to be very valuable since the pipe measurements were found to be wrong. As usual, the fluid sampler was run in on the electric wire line and that measurement checked against the pipe measurements. This feature is extremely important because if the holes are not shot in the right place the test is of little value.

Officials of one major oil company consider, as the most important feature, the fact that this equipment provides them with complete and accurate information throughout the entire test.

The surface recorder is now being adapted to other types of well testing such as intermediate bottom hole pressure tests in producing wells and for permanent installations in producing wells.



KEEP IT HANDY!

You Know You Have Good

HOLE INSURANCE

With this American Iron Releasing & Circulating Overshot on your derrick floor!

That's right! When you keep this all-purpose fishing tool and its accessories in readiness on your derrick floor, you're prepared for any fishing job . . . ready when it needs to be done. That's why we say it's good "hole insurance"! It eliminates costly delays by making it possible for you to get a fishing job under way and completed in double-quick time. Then you're back to making hole—and making money!

American Iron Overshots are ruggedly constructed; simple in design; have quick positive releasing action. (See Composite Catalog pages 234-36). And you can always get slips and packer rubbers at your nearest supply store!

AMERICAN IRON & MACHINE WORKS CO. OKLAHOMA CITY U.S.A.

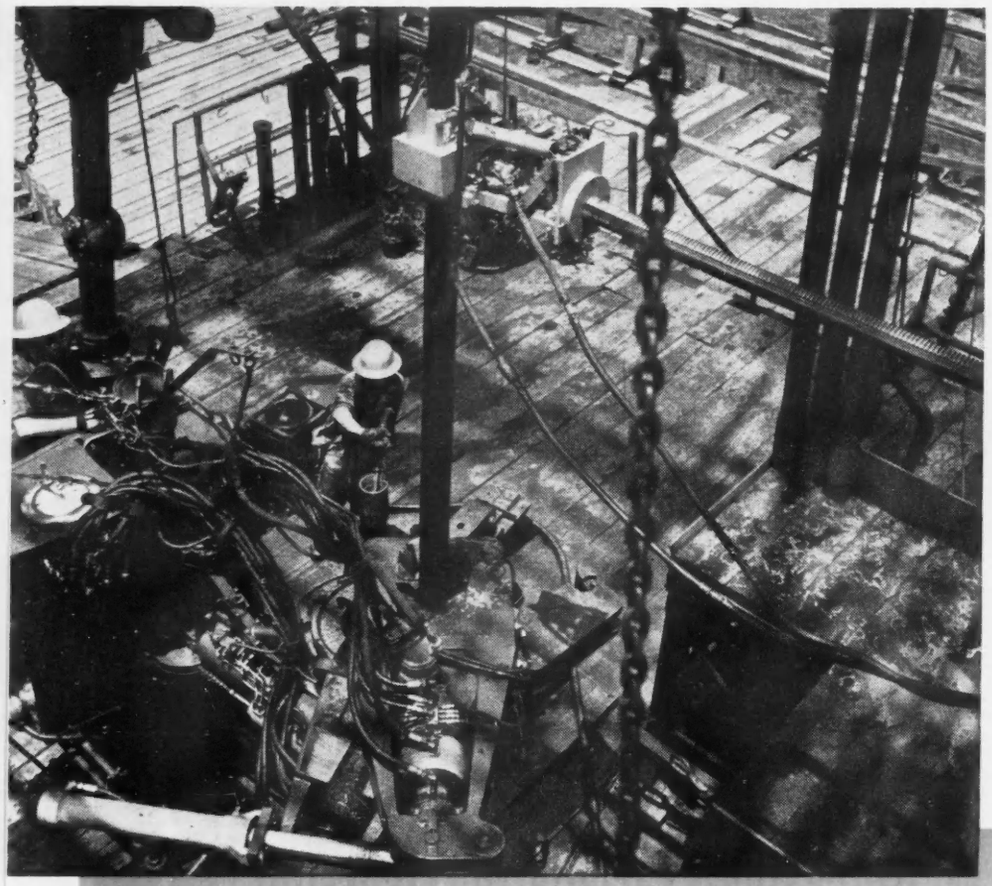
Available Thru Your Supply Store

AMERICAN IRON & MACHINE WORKS CO.

OKLAHOMA CITY, OKLAHOMA — BOX 1177 — PHONE L. D. 518

District Office: Houston, Texas

Export Office: 420 Lexington Ave., New York City, N. Y.



General view of the derrick floor showing the pipe in the transfer position. Jaws of the lower set of tongs are open and the lower racking arm is ready to take full control of the pipe. Note the elevated pipe rack.

Remote Control Power Tongs and Pipe Racker Lessen Crew Fatigue

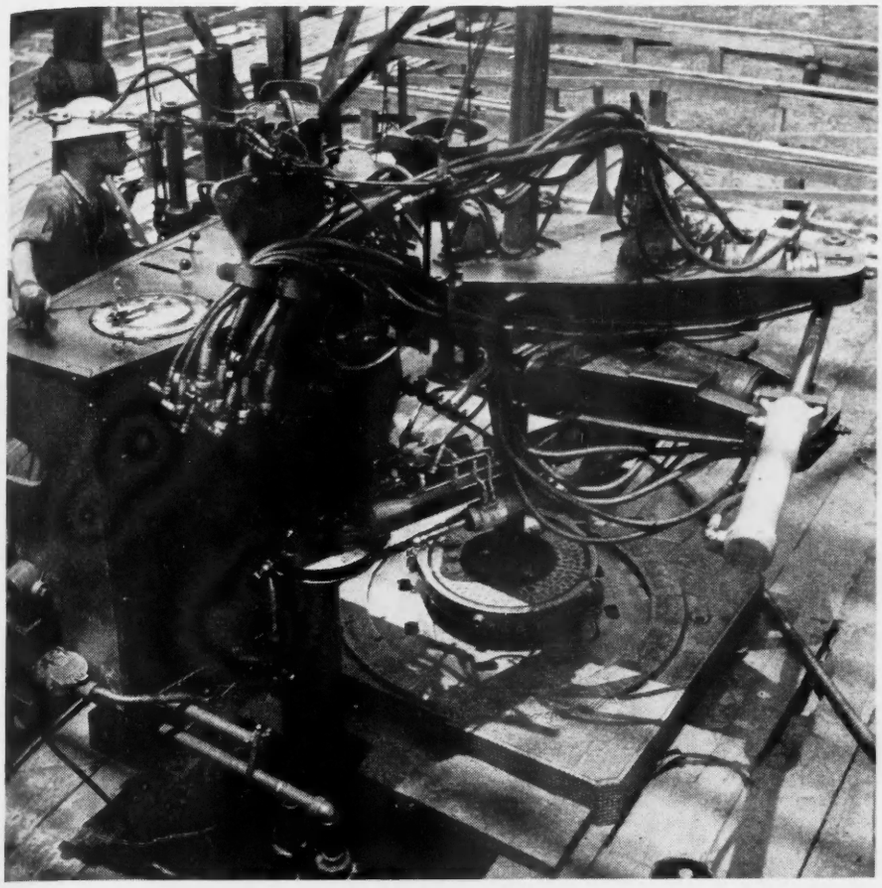
By J. E. KASTROP
Staff Writer

ENGINEERING progress in the development of automatic equipment for rotary drilling rigs has achieved two primary goals: (1), material reduction of the physical strain on drilling crews in making round trips; and (2), improved safety of drilling operations. Humble Oil & Refining Company's steam rotary drilling Rig Number 30, at present on location in the Sugar Valley field of Matagorda County, Texas, is virtually a field research laboratory and proving ground for many of the company's latest drilling equipment projects. While not yet completely perfected, the remote control power tongs and pipe racker make it possible to break, spin out, spin up and make, stab, and rack stands of drill pipe without the touch of human hands.

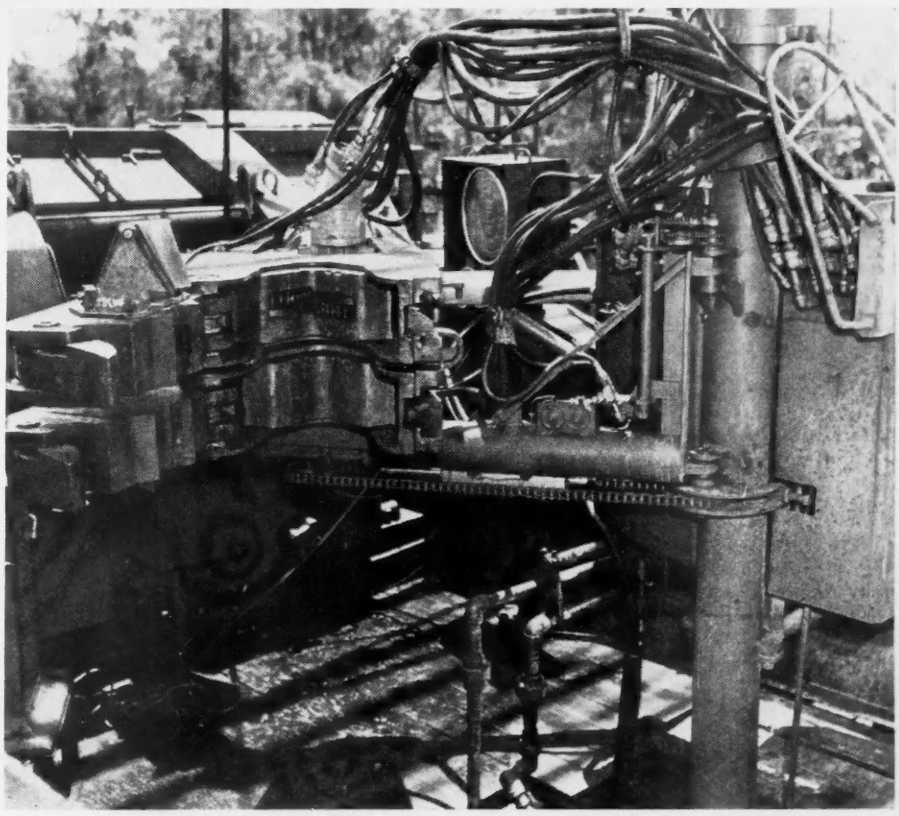
Humble instigated the development of automatic equipment to perform these and other jobs in 1945 when it was clearly shown that the trend in the industry's search for more oil and gas was to go deeper and deeper into the earth. This deeper drilling occasioned an increase in physical effort on the part of drilling crews. Round trips at depths of 12,000 feet require from eight to ten hours to complete, and dense formations encountered at these depths require that bit changes be made more often. Drilling records indicate that round trip time below 10,000 feet very often exceeds time actually spent in making hole below that depth.

Drilling crews need not fear that

THE TREND toward deeper wells brings greater strain on drilling crews and increased equipment wear. Recognizing this trend in 1945 and its effect on men and machines, Humble Oil & Refining Company started an equipment research and development program aimed at reducing as much as possible the physical effort in drilling operations. Among the most outstanding pieces of labor-saving equipment to emerge from this program are the remote control power tongs and pipe racker.



Remote control power tongs break out a stand of drill pipe with a pull of the hydraulic cylinder at right. The tong operator, shown at left, rides the large control box which is fixed to the vertical column. The maze of flexible tubing controls the flow of turbine oil to and from eight hydraulic cylinders and the hydraulic motor.



Business end of the power tongs. Note the knurled rollers and driving chains. Both tongs are supported by the horizontal arm which is hinged to the vertical column as shown. Note method of controlling sweep of the tongs.

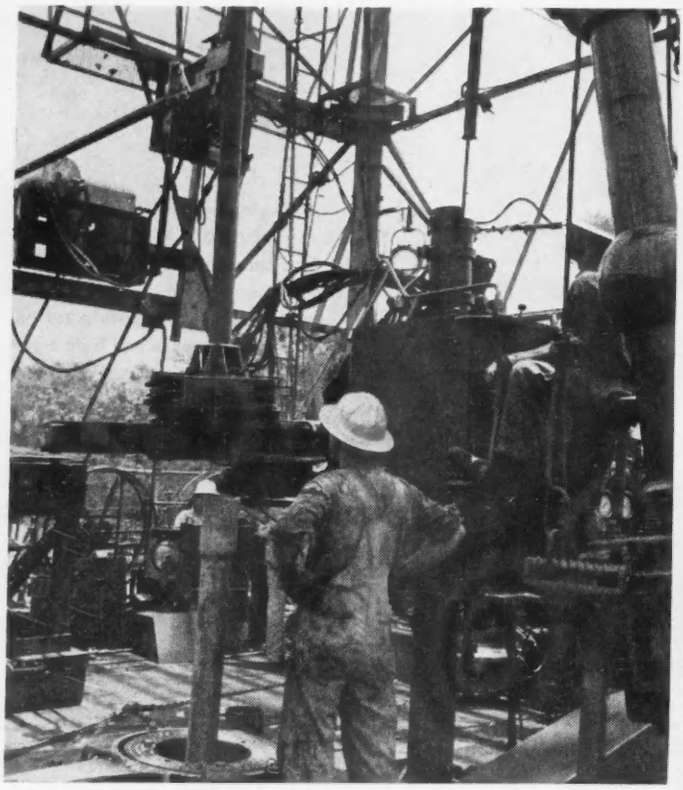
such developments will deprive them of their jobs. On the contrary, this development program is aimed at keeping the same number of men on the job and increasing their active working life on a drilling rig up to retirement age. Instead of transferring experienced personnel to less strenuous jobs at a time when they have attained a keen sense of judgment in oil well drilling, the combination of all these labor-saving devices will permit seasoned hands to remain on the rig and fill out their career in the field.

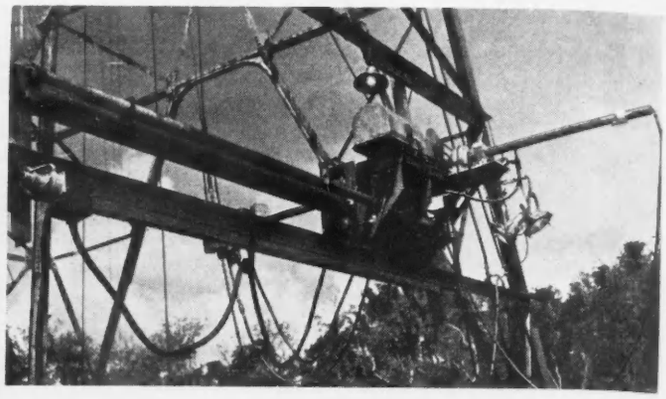
Other Accomplishments

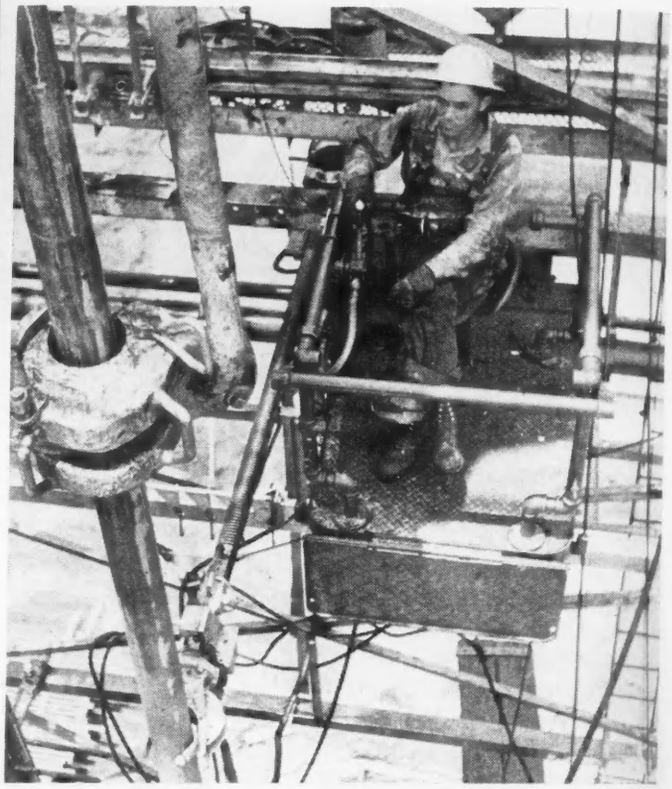
Another achievement of these new oil field tools lies in safety considerations. Drilling operations are less hazardous because they are controlled from a remote position by personnel who are less fatigued. Safety studies indicate that more accidents on the rig involve the cathead than any other piece of equipment. Most of the dangerous catheading operations are eliminated by the remote controlled power tongs.

It is expected that equipment life of many major items of drilling equipment will be substantially lengthened. Handling pipe, controlling the drilling engine, setting slips, and other operations will be performed with a degree of smoothness heretofore attained only with extreme caution.

Among other secondary accomplishments of these automatic devices is a reduction in drilling time or total time required to complete a well. When this equipment has been perfected and drilling crews are experienced in their operation, undoubtedly, much time will be saved. However, it is not expected that any saving in time will ever pay out the development and production costs of this new equipment.





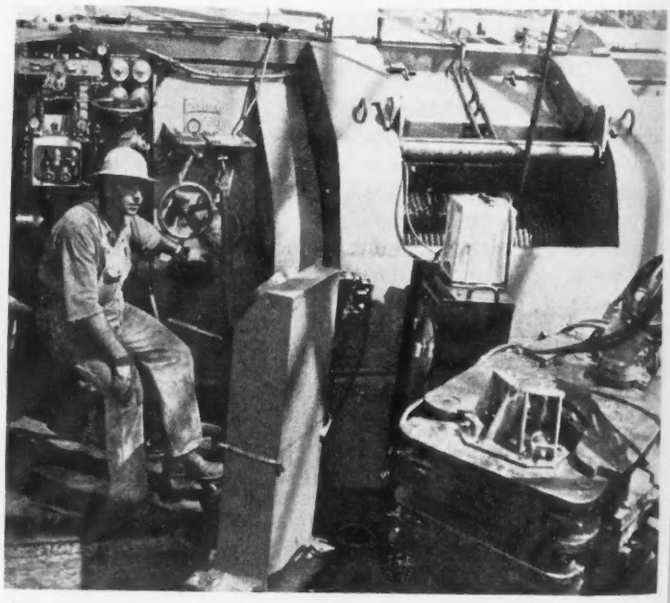


TOP LEFT: Under the control of the tong operator at right, a stand of drill pipe weighing nearly a ton is taken from the power tongs by the racking arms. This is referred to as the transfer position.

☆

TOP RIGHT: Lower racking arm unit showing relation between both lead screws. Electrical connections to both driving motors are explosion proof.

☆



CENTER RIGHT: From his seated position on the movable monkey board, the derrickman need only get up to unlatch the elevators. He controls the other operations with the "joy stick" control handle held in his right hand.

☆

LOWER RIGHT: Making hole with complete ease. Under the control of the walking feedoff brakes, weight on the bit is maintained constant, eliminating need for the hand brakes during drilling. The roller mounted above the line drum drives the recording drilling rate indicator shown on top of the electronic weight indicator.

Remote Controlled Power Tongs

Most interesting and possibly the greatest labor-saver of any new equipment are the remote controlled power tongs, even though they are still considered to be in the development stages. These hydraulically-operated tongs are designed to handle 2⅞-inch drill pipe up to eight-inch drill collars with equal ease. This equipment consists of two power tongs, operator's seat, and control box, all of which are supported on a six-inch hydraulic column having a three-foot vertical travel. The supporting column is bolted to the substructure and guyed at the top to the derrick. Its action is similar to that of a pneumatic greasing rack in a service station. The amount of vertical travel is sufficient for the tong operator, who rides on the control box, to precisely adjust the tong height to meet the junction at the drill pipe tool joint.

The two tongs are supported by a horizontal four-inch pipe which is hinged to the vertical column. A roller chain, two sprockets, and hydraulic cylinder control the sweep of the tong supporting arm and provide exact positioning within a 180-degree arc about the vertical column. The lower tong is fixed in a stationary position to this horizontal arm, while the upper power tong is pivoted to the lower tong near its head to maintain alignment of both tongs around the pipe. The upper tong handle is actuated by a two-way hydraulic cylinder which permits a scissor action of 30 degrees when making or breaking a joint. Maximum breakout torque developed is 1,600,000 inch-pounds, and maximum makeup torque is 800,000 inch-pounds. Normal operating pressure of the hydraulic system is 1500 pounds per square inch, however, 2500 psi are required to develop maximum breakout torque.

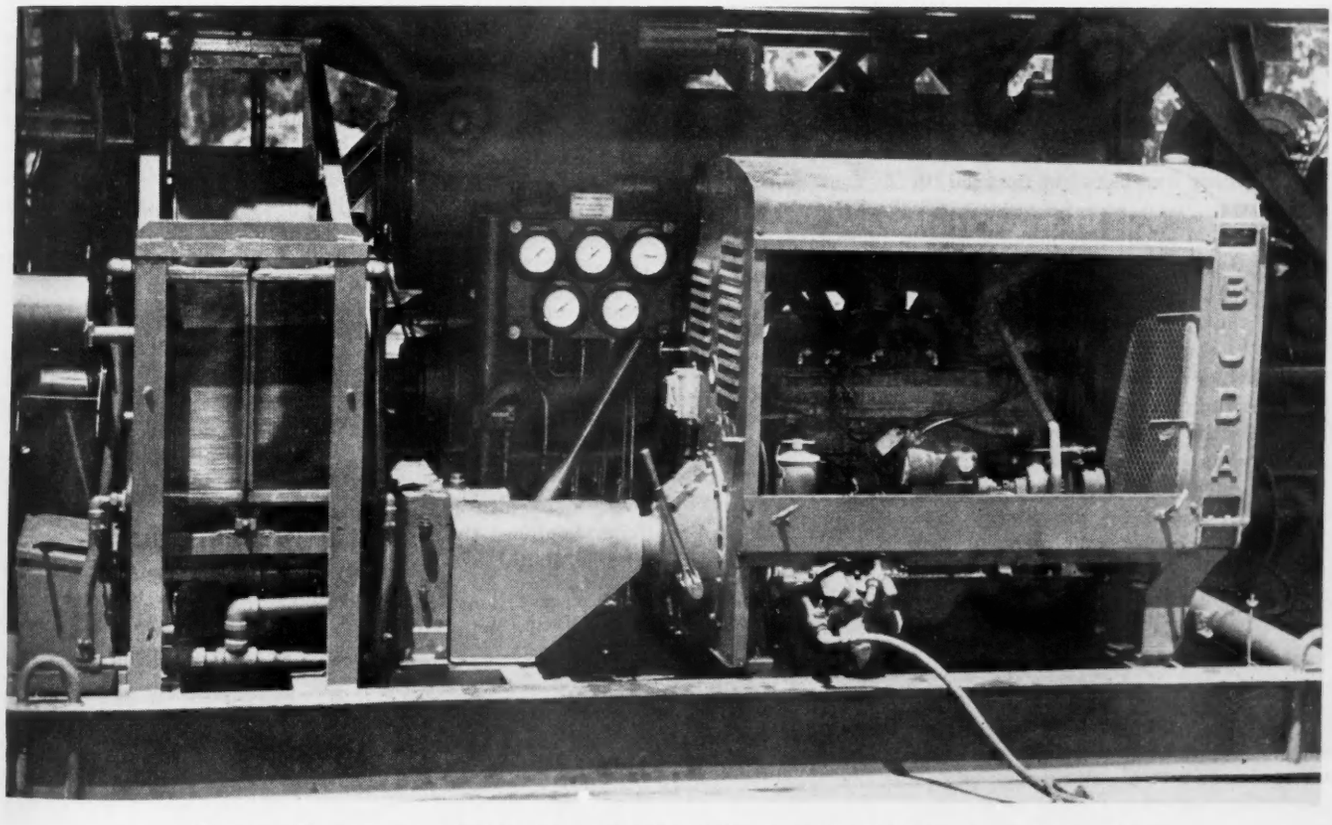
Eight hydraulic cylinders and one hydraulic motor are employed on the power tongs to perform all the operations necessary in making and breaking drill pipe joints. A 35-horsepower hydraulic motor is used to spin up and spin out the pipe at 80 revolutions per minute. Two chain-driven knurled rollers are held against the pipe under a force of 15,000 pounds and develop 8800 inch-pounds of torque. Turbine oil is used as the hydraulic fluid. Necessary volume and pressures of hydraulic fluid are furnished by a four-cylinder engine-driven pump located below the derrick floor. Contained on the same skid are the hydraulic filters, coolers, and 150-gallon supply tank.

Remote Control Pipe Racker

A stand (three joints) of five-inch, EUIF drill pipe weighing approximately 2000 pounds is easily handled for racking or unracking by two electrically-operated arms and a lifting hydraulic cylinder. One of the racker arms is located at the monkey board and a similar arm is mounted just above the first girt on the ladder side of the derrick. The lower arm is equipped with a hydraulic gripping device which firmly clamps onto the drill pipe for hoisting. A ⅜-inch cable is attached to the clamping mechanism and is suspended from a hydraulic cylinder mounted in the derrick. Purpose of the hydraulic cylinder is to carry the load of one stand of drill pipe when racking or unracking the pipe.

Both electrically - controlled racker arms remain in a horizontal plane throughout the operation. A parallelogram linkage on the lower hand or gripping mechanism permits a vertical travel of ten inches by the pipe clamp before releasing. The upper racker arm is also equipped with a clamp or hand, but it does not exert any pressure on the pipe. Instead, the pipe is free to move up or down inside the holding device. The claw on the upper arm grips the pipe on contact and is released by the control handle trigger. A finger on the claw is hydraulically actuated and controlled by solenoid valves. A safety shear pin permits the hand to drop downwards and release its grip should the arm be overweighted.

The racker arms are actually three-inch lead screws which provide a travel of two inches per revolution of the driving nut and move at the rate of two feet per second. A stationary lead



Side view of hydraulic pressure generator showing control gauges, and fluid cooling system at left on skid.

screw similar to the arm which extends into the derrick, is mounted immediately above the first girt. This lead screw construction gives the necessary lateral movement of the racker unit. The 12-foot racker arm, powered by a three horsepower, 220 volt, alternating current, three-phase electric motor, has a reach of ten feet across the derrick floor. Keyways in the lead screw prevent it from turning. The driving nut for the racker arm is powered by a V-belt drive from one electric motor, while a similar driving nut for the lateral lead screw is powered by a second motor. Both racking arms are quite similar in construction, except that the monkey board is incorporated in the upper mechanism but makes the lateral movements only.

Each arm is controlled by a single control handle similar to an airplane "joy stick" which is tilted in the direction of desired movement of the arm. This electrical switch provides simultaneous movement in both directions so that both arms can be quickly guided to any point within their reach.

Each racking unit, comprised of electrical switches, junction boxes, driving motors, base, bearings, etc., travels on a track made of four-inch pipe to which have been welded an upper and a lower guide. The monkey board racking unit has a lateral travel of eight feet, and the lower racking unit has a lateral travel of ten feet. The area of control of the lower unit is 100 square feet, while that of the upper arm is 80 square feet. The racking arm at the monkey board is controlled by the derrickman who operates the device from a seated position. When it is necessary to rack pipe manually the guard rail on the monkey board is lowered and a one-foot platform extension is secured in place.

The driller's function in making round trips when these automatic devices are used is to raise and lower the block, to operate the air slips, and to spin out pipe when coming out of the hole. The rotary helper on the floor latches and unlatches the elevators, washes the pipe, and dopes the threads. The power tong operator has complete control over all tonging operations and pipe handling from his position on the control box. He is able to control each operation with eight control valves and lower racker control handle.

Making Round Trips

When preparations for coming out of the hole are complete, the rotary helper latches the elevators and the driller hoists the drill string until one stand of pipe is out of the hole. The driller sets the air slips so that the tool joint is four or five feet above the derrick floor. The tong operator adjusts the height of the tongs to meet the junction of the tool joint, and then hydraulically latches the tong jaws. Pressure is applied so the tong dies take a firm grip on the tool joints. The top tongs are pushed outwardly by hydraulic pressure to break the joint, and the lower tongs are then released. The power tong operator, still maintaining a grip on the top tool joint, lifts the pipe slowly as the driller rotates the pipe with the rotary. Spinning out the pipe can be accomplished by the knurled rollers in the top tongs, but the operation can be done as quickly with the rotary and relieves the tong operator of this job.

When the threads are clear, the tongs are swung through a 51-degree arc towards the pipe rack which is 5.2 feet above the derrick floor and located below the monkey board. The lower racking arm, also controlled by the tong operator, is guided to the transfer position where it grips the pipe automatically on contact. The hydraulic cylinder mounted on the derrick below the monkey board takes the weight of the pipe and the tongs are released. The stand is lifted just high enough to clear the pipe rack by two inches.

During the spinning out operation, the derrickman guides the upper racking arm into the drill pipe. The claw automatically closes on contact, and the arm is retracted so the pipe is within reach from the monkey board. The driller lowers the elevators which are unlatched manually by the derrickman. Working together, the tong operator and derrickman stack the pipe in its proper position. Grip on the pipe by the lower claw is released by a push button on the "joy stick" control handle. As soon as the elevators are released, the block is lowered for another stand.

Going into the Hole

The power tong operator, controlling the lower racking arm, takes a grip on a stand of drill pipe while the derrickman does the same. Operating together, they move the pipe to the transfer position, the point at which the pipe is transferred from the racker to the power tongs. The upper set of tongs takes a grip on the tool joint and the weight of the pipe is released by the hydraulic cylinder.

The stand of pipe, supported by the tongs, is then swung into position over the rotary where the operator carefully lowers the pipe until the threads in box and pin make contact. In the meantime, the driller hoists the block in order that the derrickman may latch the elevators onto the pipe. Latching the elevators is much a mechanical operation requiring skill and good timing. As the elevators pass the monkey board, the derrickman guides the pipe into them with sufficient force to latch the elevator doors.

Powered by the hydraulic motor, the knurled rollers spin up the joint as much as possible. Grip of the upper tongs is released, the handle fully extended, and a firm grip taken on the top tool joint. With the lower tongs holding the lower tool joint, the upper tongs make a 30-degree right hand turn to tighten the joint. Successive bites are made until the joint is tight. Both tongs release their grip and the driller lifts the string of pipe, at which time he also releases the air slips. The power tongs are shifted to the transfer position to take another stand of pipe from the automatic racker. When the pipe has been fully lowered in the hole, the driller again sets the air slips and the rotary helper unlatches the elevators. The operation is repeated until all the pipe is in the hole.

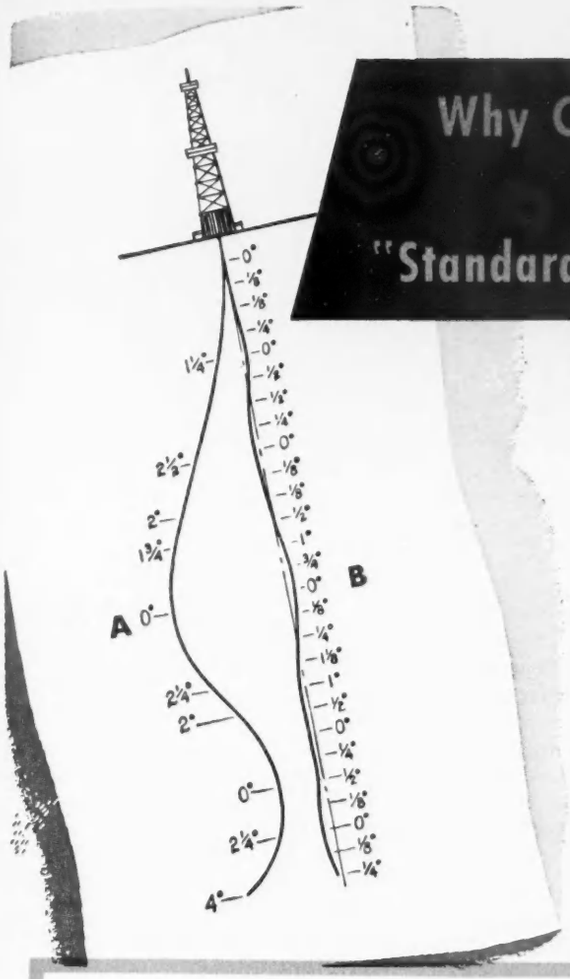
Drill pipe connections are made with the power tongs using a special vertical mouse hole located on the tong arc directly in front of the driller. When not in use, the power tongs are swung out of the way in front of the drawworks.

Significance

Humble has pioneered the development of other labor-saving devices which substantially increase drilling equipment efficiency. The automatic walking feed-off brakes which maintain a predetermined weight on the bit has contributed much towards increasing efficiencies and eliminating some of the human element in drilling oil wells. Development of a recording drilling rate indicator combined with the automatic drilling control produce a record which, when closely studied, gives an indication of depth and density of subsurface strata. Pneumatic controls for pump throttles and steam engine throttles, as well as variable governors for steam engines, do much to obtain maximum efficiency from equipment.

The success of these and other engineering developments may have far-reaching effects on drilling future wells. There has been a steady trend since the invention of the rotary drilling rig toward increased mechanization, and this trend has been given acceleration by this equipment research program. The ultimate perfection of the power tongs and pipe racker to a point where they will become standard equipment, will mark another great advancement in drilling equipment history.

Why Controlled Vertical Drilling with a TOTCO is "Standard Practice" all over the world



A straight hole is quicker, easier and cheaper to drill than a crooked one. It's a trouble-free producer, too.

The illustration at left shows why this is so. Look at hole "A." Looks like the first inclination reading was taken too late and subsequent readings were too few and too far apart to guide the driller in drilling a vertical hole. That dogleg is a natural for stuck casing or keyseating, isn't it? Efforts to correct it have only made matters worse. Chances are that there'll be a nasty fishing job in this hole before long.

Now look at hole "B." On this well the driller took frequent inclination readings, and used this information in determining the correct rotation speed and weight on the bit for drilling ahead. Not much room for trouble here, is there? And that's where Controlled Vertical Drilling really shows a substantial saving. Because trouble costs money. Stuck casing, keyseating, twist-offs, fishing jobs, backing up and re-drilling—any one or any combination of these results of crooked hole can mean the difference between success and failure from a profit standpoint.

When you think it over, can you *afford* to drill anything but a vertical hole?

The TOTCO RECORDER

Here's the instrument that can tell you exactly what's happening in the hole—the TOTCO Recorder. With TOTCO you can get an accurate, dependable reading of inclination *at any time.* Any member of the drilling crew can handle the TOTCO, and it takes only a few minutes to run it in the hole. And the driller can immediately read and correctly interpret the record the TOTCO produces.

Yes, the TOTCO Recorder is the kernel of Controlled Vertical Drilling. TOTCO Records, accurate right down to one-eighth of a degree, are the only safe guide for determining the correct drilling weight and rotation speed. You can take *frequent* readings, too, with any one of the 5 easy ways of running the Recorder.

Totco Equipment is leased or rented in the U.S.A.; sold for export only.

TOTCO supplies Go-Devils and accessory equipment for running the TOTCO Recorder on sand line or measuring line and in conjunction with wire line core barrel retrieving equipment; for dropping freely in the drill pipe; and for running in the bailer in cable-tool-drilled wells.

TECHNICAL OIL TOOL CORP., Ltd.

1057 N. LA BREA AVENUE • LOS ANGELES 38, CALIFORNIA

TOTCO

Exclusive Distributors: California — REPUBLIC SUPPLY COMPANY OF CALIFORNIA • Domestic (outside California) — CONTINENTAL SUPPLY COMPANY • Canada — OIL WELL SUPPLY COMPANY • Export (except Canada) — LUCEY EXPORT CORP., New York

Mechanics of Drill-Stem Testing

By ROY E. EDWARDS

Engineer, Mechanical Research & Development
Halliburton Oil Well Cementing Company

Part 2—CONCLUSION

IN DRILL stem testing the pressure recorded (bomb) records all pressure changes in a well during the test.

Briefly, a pressure record shows (1) the increasing hydrostatic pressure of the drilling fluid while the tester is being lowered in the well; (2) the change in pressure which definitely shows the tester valve opened; (3) the pressure changes due to flow of production from the formation through the tester; (4) the rate of build-up of natural bottom hole pressure of the production; and (5) the decreasing hydrostatic pressure while the tester is being pulled out of the well.

Referring to the illustration in Figure 19, note the unevenness of the lines marked "Tester Being Run in Well" and "Pulling Tester." This is due principally to the piston action of the drill stem as each stand is inserted or removed. Observe that the hydrostatic pressure of the mud remains constant just before seating the tool. Between the point marked "Packer Seated" and "Tester Opened," there is an increase in pressure. This is due to the piston action compressing the fluid below the packer, especially when using a rat-hole packer. The pressure should decrease, after the tool is opened, at least by the differential between the mud pressure and the formation pressure. The sudden decrease in pressure, as the tool is opened, is sometimes controlled by running a "cushion" (described under hydrostatics and packer loads).

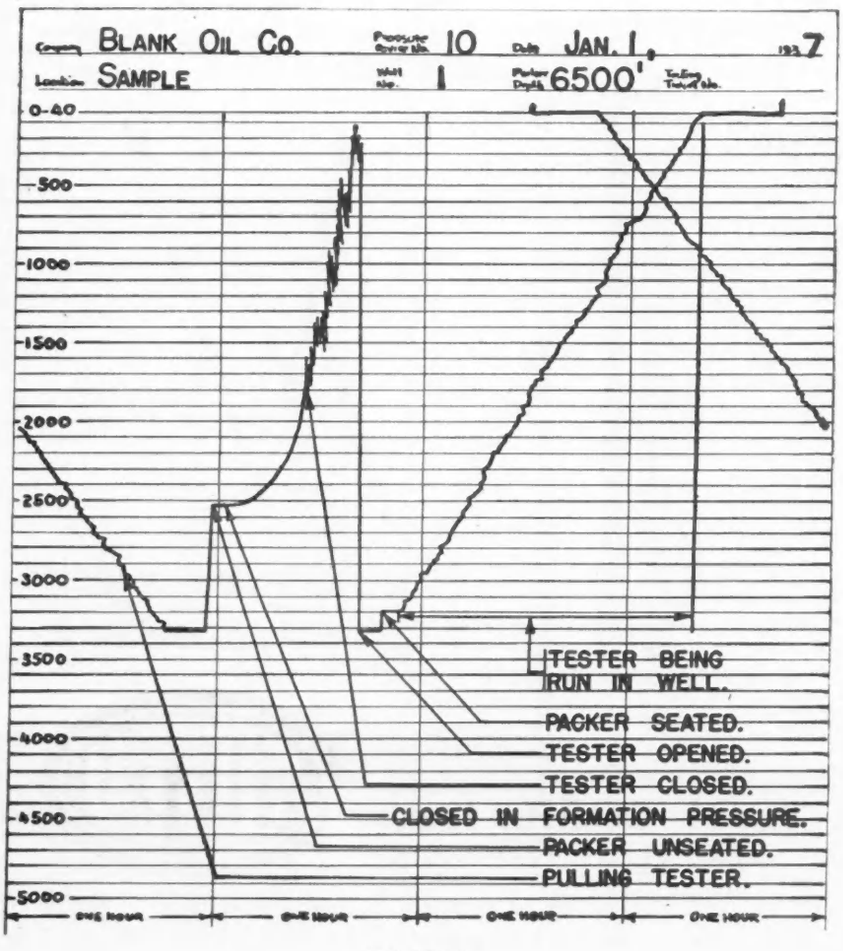


FIGURE 19

As shown in Figure 19 the pressure will build up during the flowing period because of increasing back pressure on the recorder as formation fluids flow into the drill pipe. However, if mud or other fluids are expelled from the drill pipe so that the static head is reduced, a decrease in pressure may be indicated depending on the size of choke used. The fluctuation of flowing pressure is usually more severe for gas wells, due to the heading effect. This heading effect is partially dependent upon the erratic flow of gas through the perforations in the anchor or "tail" pipe.

As the tester is opened the pressure will decrease momentarily, and if the packer or packer seat fails at this instant the pressure will increase to that exerted by the hydrostatic head of the mud. If failure occurs after the test has been in progress the pressure will increase from flowing to hydrostatic pressure. When a packer or a seat failure occurs, a movement of the mud down the hole will be observed and mud will be recovered in the drill pipe.

Failure of the tester to open will be indicated by the pressure remaining approximately the same as that at the

time of seating the tool, with no rapid fluctuations.

Clogging of Perforations

Clogging of the perforations will be denoted by a momentary decrease in pressure, as the tester is opened, and then with an increase which will remain constant and equal to that exerted by the fluid that flowed into the drill pipe up to the instant of clogging. If a single pressure recorder is used, a dry test might give the same indication. To overcome this the pressure recorder can be blanked off from the testing tool perforations. A separate set of perforations must be provided for the recorder. Another and more positive means of checking clogging is to use two pressure recorders with the lower one blanked off. As the perforations become clogged, the pressure on the blanked off recorder will increase to formation pressure. If the two pressure "bombs" are used a difference in the two recordings will be noted at the time of clogging. If the choke or the tester becomes clogged, the result would be the same whether the recorder was blanked off or not.

The pressure should approach that of the formation as the tool is closed and the packer allowed to remain seated. General practice is to allow them to remain in this condition for several minutes before unseating the packer, if such a procedure does not risk sticking the drill pipe.

When the bypass tool is opened on starting out of the hole, the pressure above and below the packer is equalized and should be approximately the same as the initial hydrostatic pressure. The swabbing effect of pulling a packer out of the rat-hole may cause a decrease in pressure to be recorded. When coming out of the hole, the pressure will fluctuate in a manner similar to going in. This is caused by the starting and stopping of the drill pipe as each stand is removed.

Damaging Pressure Gauge

Sometimes when the testing tool is spudded or allowed to slide into a rat-hole, there is a possibility of damaging the pressure gauge due to the piston action of the packer in the rat-hole. The sudden increase in pressure because of this is illustrated in Figure 20. This produces a shock load on the recording device. Another possibility of damaging the recorder is in testing the blowout preventer by closing it on the pipe. Under this condition it is possible to overload the gauge if it does not have a capacity equal to the pressure exerted by the mud column plus the pump pressure applied. Trying to reverse circulation too rapidly through restrictions in the bypass or the sudden clogging of them may cause damage to the recorder. A chart as shown in Figure 21 will be obtained. This generally occurs when the testing tool is on bottom. Rough usage due to forcing a tester into a poorly conditioned hole is illustrated in Figure 22.

FIGURE 20. Sliding packers.

There are two types of pressure gauges used in well testing service. One uses a spring loaded piston and the other uses a Bourdon tube.

A section of the piston type is shown in Figure 23. The reading on this device will never be quite the same on the return stroke as it is on the up stroke because the friction force reverses itself to oppose the motion of the piston or stylus.

The above is not true of a Bourdon type gauge, especially if the unit is not expected to operate on a precalibrated chart. This is a chart with the pressure scale printed on it. If there is any discrepancy between increasing pressures and decreasing pressures, it may be due to hysteresis of the Bourdon tube.

The best way to understand the interpretation of the pressure chart and the operations of the tester is to study actual charts.

Collapse of Pipe

One of the factors to guard against in testing is the collapsing of the drill pipe at extreme depths. There are at least three ways to overcome this:

1. Fill the pipe to a point above the minimum collapse depth. In field terms, run a "cushion."

2. Run a combination string of drill pipe or tubing.

3. Run a combination string and fill up pipe to collapse point.

Perhaps number 3 will be used only on extreme depths. Number 2 can be used in cases in which it is desirable to keep the static head on the formation at or near zero to offer minimum resistance to flow when the tester valve is opened.

Example: (See Spang Chalfant "Engineering Data")

Assume a well 13,000 feet deep with 4½-inch drill pipe, Grade D.
12 lb. mud
Collapse pressure = 6760 psi.

$$\text{Collapse depth} = \frac{6760}{5.2 \times 12.0} \times 100 = 10{,}850 \text{ ft.}$$

$$\text{Cushion required} = 13{,}000 - 10{,}850 = 2150 \text{ ft.}$$

$$\text{Hydrostatic pressure on formation } 12 \times 5.2 \times \frac{2150}{100} = 1340 \text{ psi.}$$

$$\text{Note: pressure} = \text{mud wt. (lb./gal.)} \times 5.2 \times \frac{\text{depth}}{100}$$

Example:

Assume 10.8 lb. mud
Collapse pressure of 4½-inch Grade D drill pipe is 6760 psi.
Equivalent mud weight =

$$\frac{6760}{5.2 \times 120} = 10.7 \text{ lb./gal.}$$

Collapse pressure of 4-inch Grade D, 15.70 lb. drill pipe is 8380 psi.
Collapse depth is 14,900 ft.

TABLE IV
Grade of Pipe Strength

F-25	H-40	J-55	N-80
40,000 25,000	60,000 40,000	75,000 55,000	100,000—Ultimate 80,000—Yield Point

Equivalent mud

$$\text{weight} = \frac{8380}{5.2 \times 149} = 10.8 \text{ lbs./gal.}$$

By using the 4-inch pipe no cushion would be required.
Margin = 14,900 — 13,000 = 1900 ft.

For heavier muds it may be necessary to use a smaller diameter pipe to prevent collapse and the cushion may not be entirely eliminated in some cases.
Example:

Assume 2½-inch external upset tubing was used during the test.
Collapse pressure of 2½-inch Eue tubing is 6800 psi.
Weight per foot = 6.50 lbs.
Weight of 13,000 ft. = 84,600 lbs.
Assume 12 lb. mud
Buoyant force =

$$130.00 \times 5.2 \times 12 \times \frac{2.5^2\pi}{4} = 39{,}850 \text{ lbs.}$$

The available weight to collapse the packer and operate the tester will 84,600 lbs., plus the weight of the required "cushions," minus the buoyant force.

Pulling on Pipe

Occasionally during a drill stem test in open hole the tools become stuck. Common causes are key seating, improper mud control, and cuttings and cavings.

The reader is referred to the Transactions of the API, 1940, in which the article, "Causes, Prevention, and Recovery of Stuck Drill Pipe," appears. This discussion will give some understanding of the precautions necessary to prevent sticking a string of testing tools and also methods of recovery of stuck pipe.

In casing when using a hookwall packer, these factors do not apply. Usually the tools become stuck in this case because of mechanical failure or because of junk in the hole.

It is assumed that the pull-out strength of the tool joints and couplings is equal to the strength of the pipe. The same is assumed for upset tubing. Table I gives the strength in pounds per square inch for different grades of pipe.

The pull-out strength of any size tubing may be determined by the above strengths corresponding to the current grade and by the appropriate efficiency factor (or by referring to a handbook).

Pipe will stretch when suspended in air due to its own weight. If suspended in a fluid this stretch will be reduced depending on the amount of buoyant effect. Of course, the magnitude of this effect depends on whether or not the end of the pipe is open or closed.

The stretch in steel tubing in a well can be calculated by using the following equation:

Eq. 1.1

$$e = \frac{12\,PL}{2\,AE} = \frac{12\,(W - ALd)\,L}{2\,AE}$$

The net load (P) will be equal to the weight of the pipe (W) minus the weight of the displaced fluid, or the cross-sectional area of the tubing multiplied by the hydrostatic head (ALd).

e = Elongation, inches
L = Length of tubing, or h
P = Force applied parallel with the axis
A = Cross-sectional area, sq. in.
E = Young's Modulus for steel (30 million)
W = Total tubing weight, lb.
d = Fluid density, lbs. per in. ft.

More precise expressions are available in published literature on this subject.

To the above elongation will be added the elongation due to temperature changes in the well. The expression for this is:

$$L = L_o\,(1 + 0.0000069\,t)$$

where
L = Length at average well temperature, ft.
L_o = Length at surface temperature, ft.
t = Difference between surface temperature and average well temperature, °F.

This latter factor does not ordinarily enter into the testing operation except through the possibility of the introduction of an error in depth measurement if there is any appreciable variation in well temperature between the time of the test and measurement.

The factor (e) given in equation 1.1 is entirely dependent on the density (d) of the fluid in the hole, other conditions being equal since it is dependent on the term (W — Ahd).

This expression (W — Ahd) is the floating weight which appears on the weight indicator at the instant the pipe is picked up off bottom or just prior to setting on bottom before the test is made. It is the factor that determines how much weight will be available to operate the testing tool and collapse the packer; also how much available strength is left in the pipe to pull the tools if they get stuck. In other words, the floating effect tends to relieve the stresses due to stretch.

The friction of the rubbing of the pipe against the walls of the hole will also appear on the weight indicator and tend to increase or decrease the floating weight depending on the direction of motion.

Possible Causes of Blowouts During Test

When the tool has been left on bottom a sufficient time to obtain a sample, the entire string is then withdrawn after the valve is closed. When starting the packer from the seat, it will be necessary, unless a by-pass mechanism is used, to raise the packer against the entire pressure of the mud in the hole; i.e., in a well 4500 feet, about 2000 pounds to the square inch of packer cross-section, excluding area of the drill pipe.

Under this condition the packer may be damaged and the torn part of the packer may hang on between the packer shoe and the wall of the hole, thus increasing the tendency to swab the hole. This is more likely to be true with a hookwall packer than an open hole packer because of the smaller clearances. Some types of construction used in hookwall packers tend to assume a permanent deformed shape resulting in a decrease in clearance between the packer

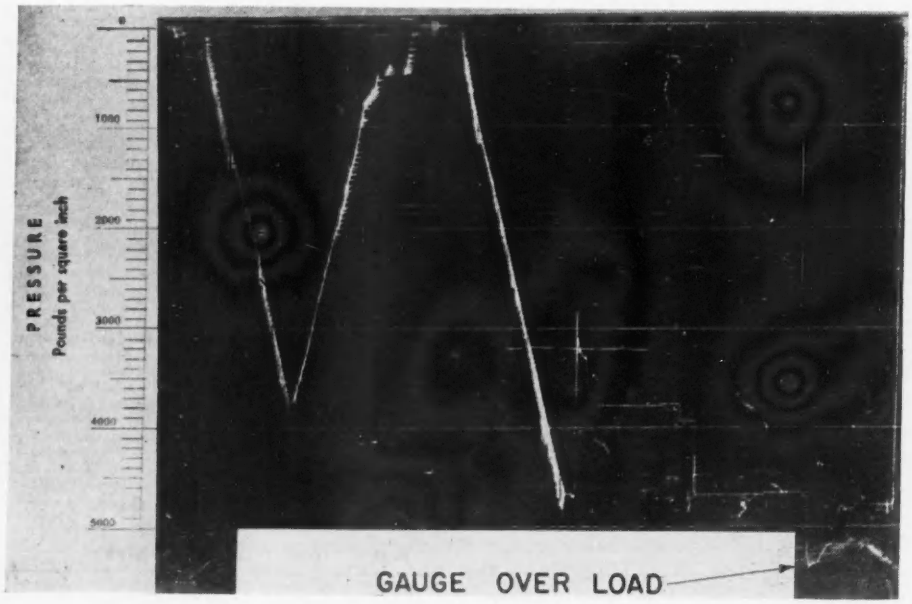
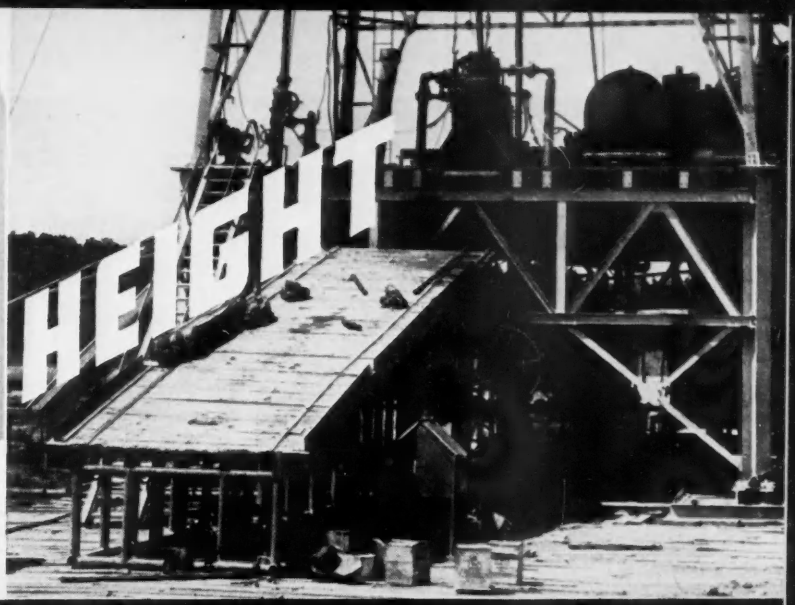
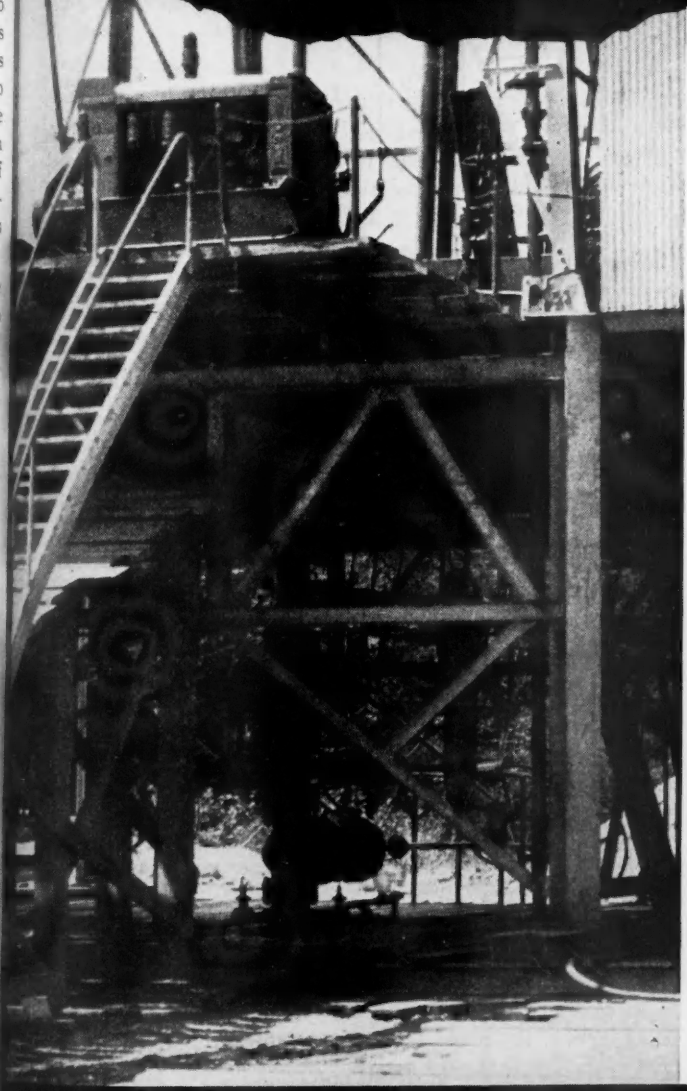


FIGURE 21. Reverse circulation.

PARKERSBURG SUBSTRUCTURES *have* HEIGHT *and* CLEARANCE





FOR SAFE, EASY WORKING BELOW THE DERRICK FLOOR

There's plenty of room for well control equipment . . . for working under the derrick floor with Parkersburg "Floor Clearing" Substructures. With plenty of clear working space workmen can do a more efficient job of setting casing heads, installing blowout preventers, setting the tubing head and Christmas tree. They can do it faster and safer because they are unhampered by crowded working quarters.

The extra height of these substructures provides space below the engine platform for tool house, locker rooms, mud house, etc. Parkersburg "Floor Clearing" Substructures are available in heights of 10′, 12′ and 14′ 6″. With all supports on the drawworks and window sides, the other two sides are left open.

Ask your nearest Parkersburg representative for details of the NRC and NC type substructures which have the height and clearance you need below the derrick floor.

THE PARKERSBURG RIG & REEL CO.

PARKERSBURG & OCS PRODUCTS

GENERAL OFFICES, PARKERSBURG, W. VA.
Plants at Parkersburg, W. Va., Coffeyville, Kan., Houston, Texas

District Offices

Dallas - Houston - Los Angeles - Tulsa - New York

OCS

PARKERSBURG

FIGURE 22. Rough usage. (Poor hole conditions.)

and the casing. A by-pass mechanism inserted in the string above the packer will allow mud in the hole to by-pass down through the packer, out through the packer, out through the perforated nipple, and into the hole below the packer, making removal of the packer from the seat comparatively easy.

In every instance the packer should be started from its seat carefully. Some excess pull above the weight of the drill pipe will always be necessary. The testing operator is familiar with these matters and will watch them. Quite often it is necessary to work the pipe, taking a strain and releasing it to work the packer in the seat to facilitate its removal. After the seat has been broken, the entire string is slowly removed from the hole. It is bad practice to pull the string of pipe and testing tool too fast because of the swabbing action which may be set up below the packer. The drill pipe displaces a large amount of fluid which will fall rapidly when the pipe is removed. The hole should be kept constantly full of mud to prevent a possible blowout or caving of the hole.

Naturally when the hydrostatic pressure of the fluid column in the well approaches or decreases to a value lower than that of the formation, there is danger of a blowout if gas is present. Accumulation of gas bubbles in rotary mud which has become too viscous will cause a reduction in the hydrostatic pressure and may cause a blowout.

Very often the first indication of a blowout is increasing gas content in the returns. This is always a signal of danger. Mud rising in the hole when the pumps are not running is evidence of increasing pressure in the hole. When the pump shows a sudden decrease in pressure during circulation and seems to run away or will not keep up with the amount of mud coming out of the hole, a blowout may be imminent. The speeding of the pump is due to a lessening of the hydrostatic pressure in the well. These conditions could occur when the tester is being pulled out of the hole.

If it is known that there is danger of a blowout, a tool is available that can be

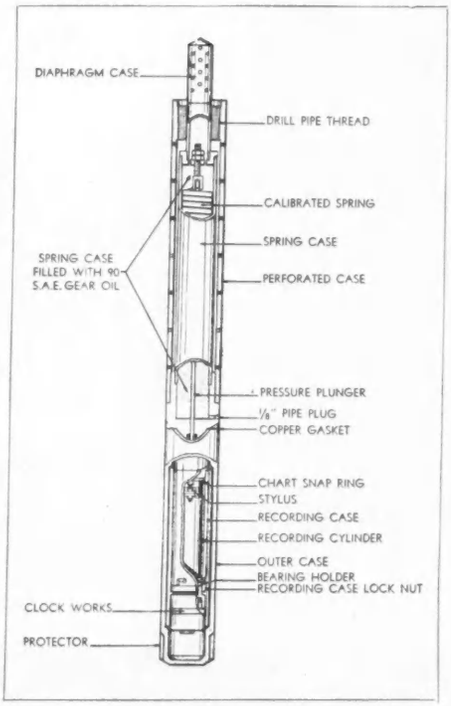


FIGURE 23. Bottom hole pressure-recording device.

run in the testing string to permit circulation of the well. This device is known as a two-way circulating valve. It does not interfere with normal procedure when making a test and is usually installed at a distance equal to one or two stands of drill pipe above the tester. This valve is constructed to be opened by application of pump pressure to the drill pipe. In a locked-open position, fluids may be pumped through the annulus or drill pipe in either direction; thus, the tool can be utilized to remove fluids from the drill pipe or to condition the mud in the annulus.

Flow

There are several simple methods of measuring the flow of gas or oil on a drill stem test when more accurate methods are not available and an estimate is desired. The most common methods are with a side static gauge for gas and horizontal open end pipe for oil flow. The various methods of measuring gas flow and the open end pipe method for oil are described in several readily available handbooks.

Derrick Strengths

Due to poorly conditioned hole or caving formations the pipe can stick during a drill stem test. It may be necessary to pull on it.

The loading on a derrick is complex under these conditions and varies considerably with such factors as eccentricity of load, wind load, impact, etc. Generally, the greatest dead load that the derrick will support is that of the heaviest column of casing to be inserted in the well. The testing operator will have to assume that the derrick is strong enough to pull on the pipe if the testing tools become stuck.

Under conditions where the well owner anticipates sticking difficulty it is possible to run with the testing assembly a jar and/or a safety joint. Several jars are available which will effectively assist in freeing stuck packers without the necessity for extremely hard pulling. The safety joints allow the pipe to be backed off above a stuck packer.

ACKNOWLEDGEMENT

The writer wishes to express his appreciation to W. D. Owsley, C. E. Clason, John Padgett, and C. C. Olson, and to the Halliburton Oil Well Cementing Company for information furnished from the Mechanical Research and Development Department in the preparation of this article.

REFERENCES

[1] O'Neill, "Improvements in Formation Testing," TRANSACTIONS API, 1939.

[2] HOWCO Formation and Casing Testing, Halliburton Oil Well Cementing Company, 1940.

[3] Padgett, "Formation Testing and Testing Equipment," March 24, 1947.

Simplified Design Calculations for

Combination Casing Strings

DESIGN of combination casing strings has been greatly simplified by a new method of dealing with collapse resistance. So-called combination casing strings, which are engineered to reduce the weight of long strings of casing for reasons of economy or to reach greater depths without strengthening the joints, require special consideration in design when collapse resistance is a factor. Although tension and burst computations are relatively straight-forward and standardized, collapse computations have been more complex, involving trial assumptions and time-consuming operations.

A new method offered by B. E. Curran, assistant director of research, Spang-Chalfant Division, The National Supply Company, gets results directly by means of a single formula and an accompanying table of parameters. This table may be expanded if necessary, using the indicated formulas for parameters.

The formula for minimum allowable length (x) that will permit the "unadjusted minimum nominal collapse resistance" (K) at the lower end of an upper section to support the prevailing collapse pressure at a depth of (L — x), as shown in Figure 1, with a safety factor (F) is:

$$x = \frac{L}{a} + \frac{n}{b} - c\sqrt{1-\left(\frac{L+n}{d}\right)^2} \quad (1)$$

For those who prefer working with trigonometric tables this formula can be written:

$$x = \frac{L}{a} + \frac{n}{b} - c \sin\left[\cos^{-1}\left(\frac{L+n}{d}\right)\right]$$

where L = depth to bottom of section being calculated and n = W/w = ratio of total hanging load below the section to weight per unit length of casing in the section being calculated.

The variables or parameters (a, b, c and d) in this equation are all functions of a ratio (m = u/v) which is evaluated by simple formulas that include all of the necessary variables in the problem. All of these quantities and formulas for each are given for 11 weights of casing in Table 1, columns 12 to 18. The varia-

TABLE 1

Tabulated setting depth parameters for seven-inch outside diameter casing for use in formulas for determining critical length of sections affecting collapse resistance.

LOWER SECTION						UPPER SECTION					COLLAPSE PARAMETERS						
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
WEIGHT PER FOOT	GRADE	THICKNESS	D/t	MINIMUM COLLAPSE PRESSURE	SETTING DEPTH $F_c = 1.0$	WEIGHT PER FOOT	GRADE	CROSS SECTIONAL AREA	AVERAGE YIELD STRESS	MINIMUM COLLAPSE PRESSURE	$\frac{As_o}{w}$	$\frac{K}{pF_c}$	$\frac{u}{v}$	$1-\frac{\frac{m-2}{m(2m-1)}}{}$	$\frac{m(2m-1)}{m-2}-1$	$\frac{u}{\sqrt{1+m(m-1)}}$	$\frac{2v}{\sqrt{3}}\sqrt{1+m(m-1)}$
w	-	t	-	-	-	-	-	A	s_o	K	u	v	m	a	b	c	d
17	H-40	.231	30.30	1370	2436	17	F-25	4.9123	35000	1100	10114	1956	5.1708	.9344	14.234	2129	10731
20	H-40	.272	25.74	1920	3413	17	H-40	4.9123	50000	1370	12281	2436	5.0415	.9336	14.056	2656	13005
20	J-55	.272	25.74	2500	4444	20	H-40	5.7492	50000	1920	14373	3413	4.2113	.9293	13.136	3771	15019
23	J-55	.317	22.08	3290	5849	20	J-55	5.7492	65000	2500	16248	4444	3.6562	.9282	12.935	4965	16792
26	J-55	.362	19.34	4070	7236	23	J-55	6.6555	65000	3290	16638	5849	2.8446	.9367	14.793	6657	16881
23	N-80	.317	22.08	4300	7644	26	J-55	7.5491	65000	4070	21334	7236	2.9483	.9343	14.224	8215	21699
26	N-80	.362	19.34	5320	9458	23	N-80	6.6555	85000	4300	21758	7644	2.8464	.9366	14.782	8699	22076
29	N-80	.408	17.16	6370	11324	26	N-80	7.5491	85000	5320	22127	9458	2.3395	.9606	24.352	10883	22204
32	N-80	.453	15.45	7400	13156	29	N-80	8.4494	85000	6370	22444	11324	1.9820	1.0031	-327.37	13075	22444
35	N-80	.498	14.06	8420	14969	32	N-80	9.3173	85000	7400	22628	13156	1.7200	1.0667	- 15.989	15125	22728
38	N-80	.540	12.96	9080	16142	35	N-80	10.1725	85000	8420	22754	14969	1.5201	1.1547	- 7.4624	17005	23128

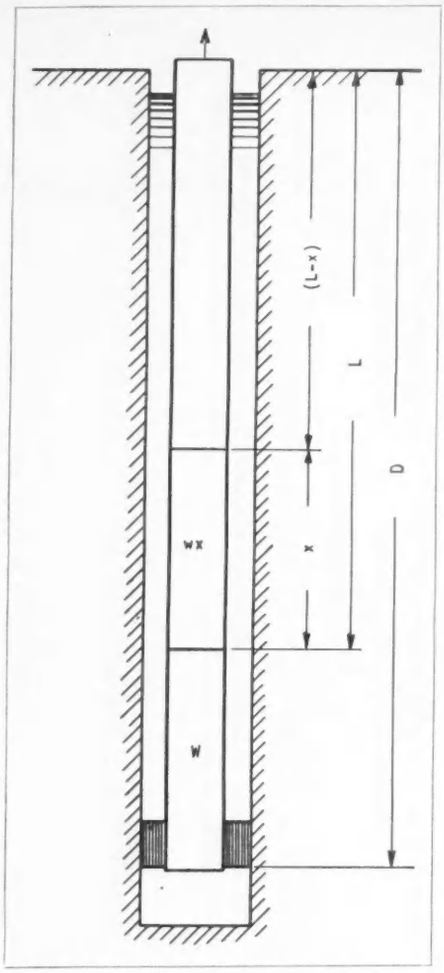


FIGURE 1. Diagrammatic sketch of a combination casing string suspended in a well filled with fluid surrounding the casing in the annular space but having no access to the inside.

bles in the collapse parameter formulas which have not been previously defined are:

A = metal cross-sectional area at the lower end of section at depth (L — x) in Figure 1.

s_o = average yield strength of material of above section.

p = hydrostatic pressure gradient

u = equivalent setting depth in tension of the body of the pipe, irrespective of joint strength. It is based on average rather than minimum properties because the effect of tension on collapse is based on the average value.

v = maximum allowable setting depth in a well filled with fluid developing the hydrostatic pressure gradient (p).

The use of this method of collapse computation may be illustrated by the design of several of the lowermost sections of a seven-inch outside diameter combination string for a 16,000-foot hole, assuming a hydrostatic pressure gradient

Combatting Drill Stem Corrosion

In a study of drill stem corrosion prepared by G. L. Corrigan and A. E. Schlemmer and presented in full before the Petroleum Division of the American Society of Mechanical Engineers at Amarillo, Texas, it was emphasized that drill pipe is under constant attack by its environment when stored, standing in the derrick or when in use. Many of the factors frequently tend to cancel each other, but in the case of some, combination aggravates the activity. The authors summarized their paper by pointing out:

"The best means for combatting pure chemical solution of the iron and the resulting corrosion is to watch closely for changes in the pH of the fluid and to maintain fluid velocities and rotational speeds which will tend to minimize turbulence in the flow column. The use of non-electrolytic drilling fluids, such as the oils, resins and others, and the addition of pH-modifying agents such as chromates will all aid.

"Any treatment which will render the surface more nearly homogeneous and free from mechanical irregularities will act as a control. The treatments in use include wire-brushing, sand-blasting, shot-peening, and coatings of either the neutral or anodic protection type. Use of chromates may act as an electrochemical corrosion inhibitor through deposition of chromium from the chromium salts. Wire-brushing and sand-blasting could be detrimental if the surface is not treated uniformly, by destroying any existing protection and forming corrosion cells with the remaining portions of the former surface. Coatings acting neutrally or as cathodes with respect to the iron must be watched carefully since any break in the coat may set up a concentrated cell which will ultimately destroy the value of the stem or cause it to fail.

"The use of neutrally coated stems with short sections of uncoated stem is extremely dangerous due to the concentrated anodic nature of the unprotected areas. This is, in effect, probably equal to a wet cell battery using the corrosive fluid as an electrolyte, the protected iron as a cathode and the unprotected iron as an anode.

"In electrolytic solutions, any broken areas in mill scale surfaces may promote the formation of anodic points. In removing mill scale it is not absolutely necessary to remove all of the scale since minor chips and flakes will act as small cathodes in a large anodic area, dissipating their effect.

"The dissipation of the attack of the corrosive forces is another of the aims of all methods of alleviation of corrosion problems. Although it is impossible to prevent corrosion action, if these forces are spread over a sufficiently large area and are not allowed to concentrate, their effect will be relatively harmless for the amount of metal lost in corrosion is a very minute factor in any consideration of the damage caused."

of 0.5 pound per square inch per foot of depth and a safety factor of 1⅛-in. collapse, which is normal for the tabulated values in Table 1.

The 38-pound N-80 grade is required for the bottom section, the table shows. For the second section thirty-five pound N-80 is arbitrarily selected. The problem is then to determine the shortest length of 38-pound N-80 that will permit the use of 35-pound N-80 in the next section above it and still be able to support the prevailing hydrostatic pressure at the required safety factor.

Since there is no hanging load (W) to be considered with the bottom section, the formula is simplified by making n = O. Applying collapse parameters (a, c and d) in the bottom line of Table I, columns 15 to 18, the length of the section is:

$$x_1 = \frac{16{,}000}{1.1547} - 17{,}005\sqrt{1-\left(\frac{16{,}000}{23{,}128}\right)^2}$$
$$= 13{,}856 - 17{,}005 \times 0.72209$$
$$= 1577 \text{ feet}$$

Using a rounded figure of 1600 feet of 38-pound N-80 adds a hanging load (W) of 60,800 pounds to be included in computing the length of the next section. This makes n = 60,800/35 = 1737 feet. This is the equivalent length of 35-pound casing. Applying collapse parameters corresponding to a change from 35-pound to 32-pound casing, the length of the second section is:

$$x_2 = \frac{14{,}400}{1.0667} + \frac{1737}{15.989} - 15{,}125\sqrt{1-\left(\frac{14{,}400+1737}{22{,}728}\right)^2}$$
$$= 13{,}391 - 15{,}125 \times 0.70420$$
$$= 2740 \text{ feet}$$

Calculations for the third section of 32-pound casing are similar, this time based on a rounded figure of 2800 feet in the second section and a hanging weight of 158,800 pounds. The formula gives $x_3 = 2725$ feet, which may be rounded to 2800 feet.

Since these calculations are only illustrative, they do not consider the possibility that the next section might have to be heavier pipe because of increasing tensional load. This is beyond the scope of these studies.

Greater details in the derivation and proof of formulas are available to anyone who is interested.

Any V-BELT Changes Shape *when it Bends*

Prove this yourself!

That's Why the CONCAVE SIDE

(U. S. PATENT NO. 1813698)

Gives You 2 Big SAVINGS!

Bend *any* V-Belt and *f e e l* it change shape. The top, under tension, *narrows*. The body, under compression, *widens*. The sides of the belt bulge out.

Straight-Sided V-Belt

Straight-Sided V-Belt Bulges in Sheave-Groove.

The result, if the belt is built with *straight* sides, is a shape that does not fit the sheave groove — as shown in Figures 1 and 1-A, above.

Now, bend the V-Belt built with the precisely engineered Concave Side (U. S. Patent No. 1813698) — the Gates Vulco Rope.

Gates Vulco Rope With Concave Side.

No Side Bulge. Precise Fit in Sheave Groove.

You get the same shape change but *now* the new shape *exactly fits* the sheave groove as shown in Figures 2 and 2-A.

Results— (1) *Uniform* side-wall wear; *longer* life. (2) *Full* side-wall grip on the pulley; carries heavier loads and sudden load increases without slippage—a big increase in drive efficiency—saving belt wear a n d also saving power!

REG. U. S. PAT. OFF.

The Mark of SPECIALIZED Research

The Concave Side is MORE IMPORTANT NOW Than Ever Before

Because the *sides* of a V-Belt are what actually *drive* the pulley, it is clear that any increased load on the belt means a heavier load that must be transmitted to the pulley *directly* through the belt's side-walls.

Now that Gates *SPECIALIZED* Research has m a d e available to you SUPER Vulco Ropes—carrying fully 40% higher horsepower ratings—the life-prolonging Concave Side naturally delivers greater savings today than ever before.

GATES VULCO ROPE DRIVES

Engineering Offices and Jobber Stocks IN ALL INDUSTRIAL CENTERS of the U. S. and 71 Foreign Countries

THE GATES RUBBER COMPANY
DENVER, U.S.A.
"The World's Largest Makers of V-Belts"

Causes and Prevention of Drill Pipe and Tool Joint Troubles

By H. G. TEXTER
Spang-Chalfant, Inc., and
R. S. GRANT
Hughes Tool Company
Revised by H. G. TEXTER, Chief Field Engineer, Spang-Chalfant Division of the National Supply Company, and S. C. MOORE, Product Engineer, Hughes Tool Company

THIS IS THE FOURTH of a series of articles which describes causes of drill pipe and tool joint troubles and practical ways of preventing them. The series revises a widely acclaimed paper presented under the same title before the American Petroleum Institute's Twenty-Second Annual Meeting at San Francisco on November 6, 1941. To give readers both the new thoughts on the subject and also the benefit of the very thorough discussion presented in the original manuscript, the old text is reprinted in full in our standard type face and the revisions indented in larger type. The effective revision date is August, 1948.

Reprints of the series in pamphlet form will be available following completion of publication in WORLD OIL. Those desiring reprints should request copies as soon as possible.

Part 4 DRILL PIPE—Continued

7. Worn Pipe

Some drill pipe troubles are almost too obvious to need mention, except to point out how certain operators handle the problem. Worn pipe is a good example.

If kept straight throughout its life, drill pipe can wear quite thin without showing any evidence thereof. This is especially true in deep fishtail or easy rock-bit drilling, where little weight is carried on the bit and, therefore, little or none of the pipe is in sufficient compression ever to bend it.

Formerly the wear on the tool joints was the determining factor. Inasmuch as in fishtail drilling there are relatively few fatigue or corrosion-fatigue failures, experience indicates that the pipe and tool joints wore about equally, so that when either was worn too thin it was not worthwhile replacing the other. Upwards of 150,000 feet of hole is not at all uncommon for drill strings in this type of service. Such strings were only laid down, or degraded into line pipe, when the tool-joint shoulders were so thin—in the opinion of the drilling superintendent or tool pusher—that they no longer would make a reliable seal; or when some few fatigue failures began to develop in the pipe.

Today, however, most operators make outside-diameter measurements from time to time, and throw out lengths which show diameter readings below a certain minimum. One large Gulf Coast operator, for example, sets this figure at 4.430 inches for 4½-inch drill pipe. A well-known drill pipe inspection firm checks 4½-inch 16.60-pound pipe to 4.434 inches, and the 18.10-pound weight to 4.425 inches.

> The consensus of opinion now is that 4½-inch O.D. 16.6-pound drill pipe can be used quite safely when worn to 4.375 inches. This is an allowable wear of one-eighth inch on the diameter or one-sixteenth inch on the wall and assumes fairly concentric wear. Or, looking at it another way, drill pipe may be used until worn to some 80 percent of its original wall area, but with the understanding that its tensile strength is then only about 80 percent of its original strength.

These outside-diameter checks for wear usually are made the first time the strings are brought in for general tool-joint repairs, at about 75,000 feet of drilling for average Gulf Coast work. Simple no-go gauges are used, and checks are made at several points along each length and at several points around the circumference. The inspector uses some discretion, based on experience, and does not necessarily throw out every length over which the no-go gauge will pass. What he really is looking for are spots of badly eccentric wear, most of which could be found by feeling with the hand.

Although it would seem that drill pipe always should wear concentrically, if always kept straight and if always run in tension, there are apparently exceptions to this rule, especially in high-speed rotation. In Turner Valley, Canada, for example, drill pipe is handled quite carefully, and is kept unusually straight; but, in spite of this, many lengths show very eccentric wear. It is particularly noticeable on the tool joints.

A possible explanation of this is that, at some critical speed, the pipe ceases to rotate around its own true axis, but takes on a sort of centrifugal "swing" which keeps one side of the pipe rubbing hard against the hole. At least this is the theory of one Canadian operator, and it is an interesting idea.

The average rotating speed in Turner Valley is from 150 rpm to 250 rpm, and occasionally as high as 450 rpm. Being definitely above the speeds in the Mid-Continent which apparently do not give eccentric wear, and definitely under the very high speeds now being used in California, it seems quite possible that

BETHLEHEM *PIERCED* FORGINGS

can save you production steps

Pump liners are one of the many types of parts that can be made easily and economically from Bethlehem pierced forgings. We show a group here because they well illustrate how production steps can be saved through the use of these forgings.

Note the double collars. Actually, each forging is a single piece, with the collars integral. When the customer receives these units nothing remains to be done but finishing operations. He isn't faced with the costly, time-wasting step of welding or shrinking the collars into place. And there's no chance whatever that a collar can loosen up or pull away.

Perhaps investigation would bring to light ways in which you could use Bethlehem pierced forgings to advantage. Remember, Bethlehem anneals or heat-treats your order as required and rough-machines to your specifications. Ask a Bethlehem representative for complete details.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
On the Pacific Coast Bethlehem products are sold by
Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

★ BETHLEHEM STEEL ★

there are critical speeds which cause uneven wear, or even crooking, under otherwise ideal conditions.

8. Crooked Pipe

Drill pipe can become crooked during transportation, in railroad cars, in unloading, in trucking, and even while pulling into the derrick or laying down for racking. This is particularly true of range 3 pipe, and is an objection to using this range. The remedy is obviously that of taking greater care in all handling operations.

It can become crooked in the well, by being made up with grief stems, drill collars, subs, or tool joints in which the taper joints are out of alignment, or even in which the pipe itself was threaded out of alignment. Here the trouble is a manufacturing fault, and the remedy is obvious.

Most often drill pipe becomes crooked in service at the bottom of the string, where insufficient drill collar is being used and where some of the drill pipe is run in compression. Again, the remedy is obvious.

If used in a crooked condition, even slightly crooked, the pipe is in danger of wearing thin on the convex side of the bow. In rock-bit or other abrasive formations this wear takes place quite rapidly, and breaks can occur readily.

More often, however, rotating crooked drill pipe sets up heavy bending stresses, and causes fatigue failures. This is true even in the case of but slightly bent lengths.

Another common cause of crooked drill pipe is careless handling while going into the hole. If the bit hits an obstruction, such as a slight bridge or heavy filter cake, it might be stopped suddenly enough to throw the whole string into compression. This undoubtedly would crook the bottom joints almost as though the string had been dropped to the bottom. Obviously this cause of crooking drill pipe can be avoided by watching the weight indicator quite closely while going into tight or cavey holes.

Careless tonging of taper joints can throw a short kink into the box end of drill pipe, just above the point where it sets in the rotary slips. Having the pipe set too high is particularly dangerous, but probably the most frequent cause of this trouble is the careless use of the automatic cathead in making up or breaking out the taper joints.

An absolute prevention of crooking by tonging would be to place a backup tong immediately under and parallel to the lead (or jerk) tong, and extending out on the same side of the tool joint. Then there would be no bending moment involved, only pure torque; but there is no easy way to rig up for this. Therefore, all that can be done is to exercise care in using the tongs so that the bending moment will be as small as possible.

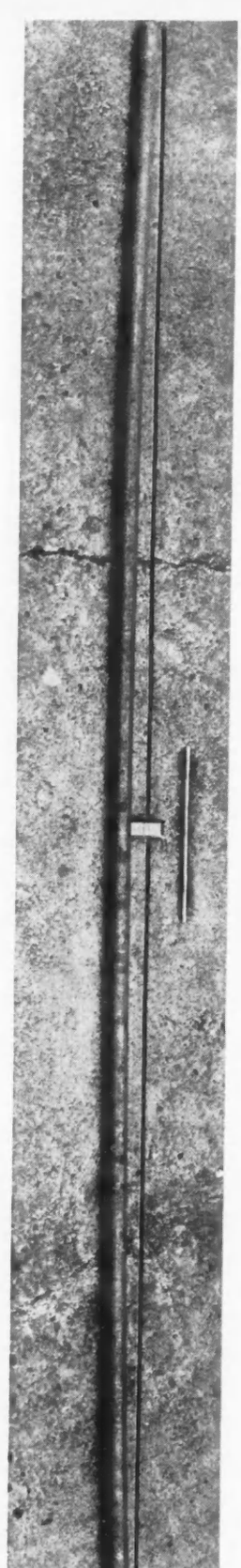


FIGURE 30
Drill pipe bent by peening

Occasionally it has been found that drill pipe can become crooked in the upper part of otherwise perfectly normal drilling strings due to a "whipping" effect. This was noticed especially in the early days of the Oklahoma City field where some drilling was done inside of fairly long strings of large diameter (13⅜-inch) surface casing.

Apparently there was nothing to stop the drill string from taking on such a large amplitude of vibration that the pipe just "threw" itself into a crook. Probably a mathematical study of this problem could indicate what critical depths and speeds cause this type of crooking, but it happens so seldom that no great thought ever has been expended on the subject.

> A peening effect might, conceivably, be the cause of crooking pipe in the upper part of a drill string. This could be the result of a rhythmic slapping of *one side* of the pipe against the surrounding casing, repeated thousands of times, possibly aggravated by some critical speed of rotation.
>
> To check this possibility in the laboratory a length of drill pipe was peened along one side only, with a blunt nosed air hammer, until it took the form of a long bow, as shown in Figure 30. The peening had elongated the steel, longitudinally, causing the 30-foot length to bow 2¾ inches out-of-straight, with the peened side being the convex side.

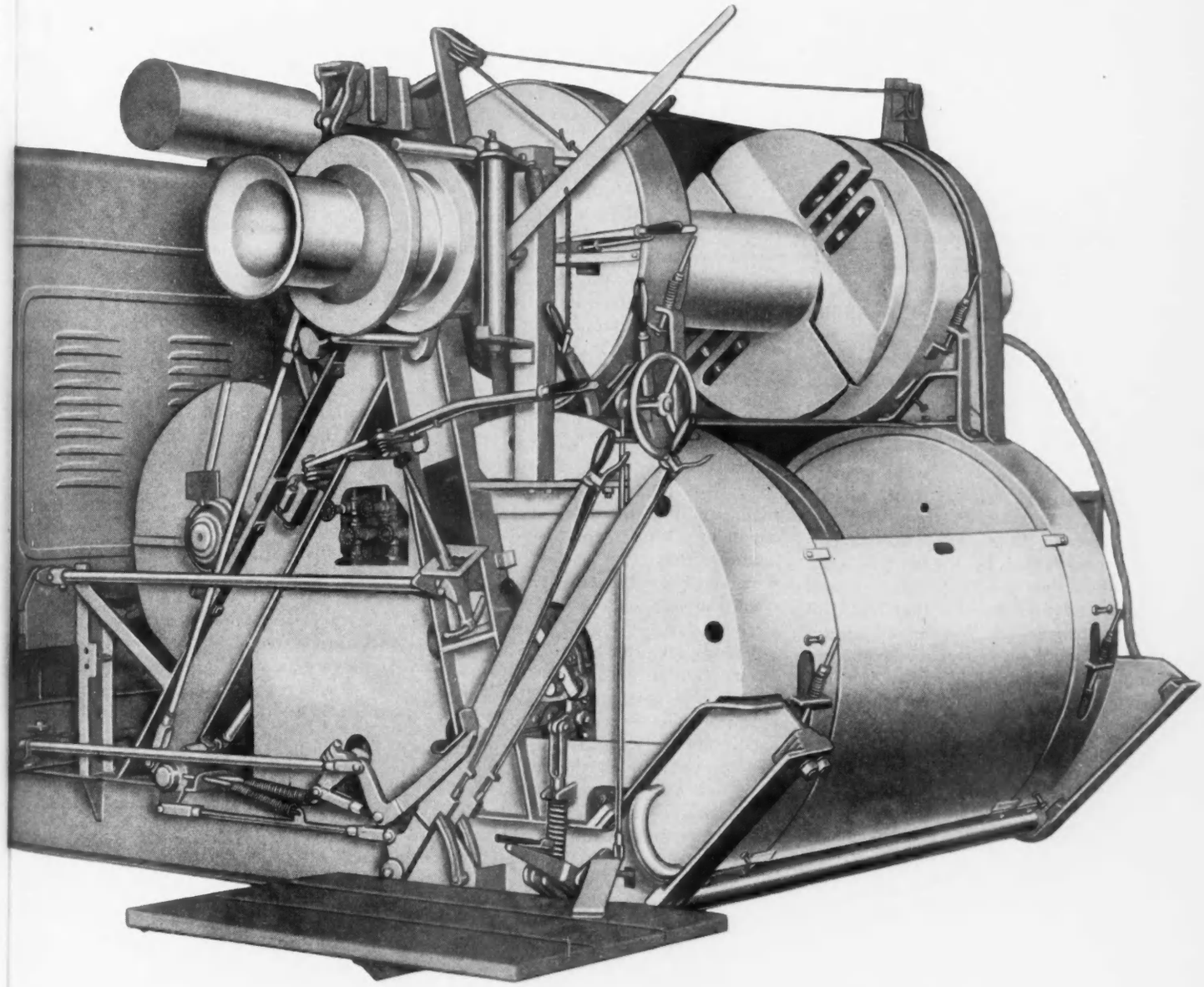
Inasmuch as crooking from any cause is a prime cause of fatigue failures, it is very important to keep all elements of a drilling string in perfect alignment. Kellys, drill collars, subs, and their thread alignments can be checked with optical instruments; and the pipe itself, as it rolls on the rack, can be checked by a practiced eye.

Pipe which does not roll reasonably straight should be discarded or straightened at once. Many operators and contractors keep portable, hydraulic straighteners right at the rig, and use them to very good advantage. There can be no harm from straightening drill pipe a number of times, unless the kinks were so sharp that the pipe had been buckled even a small amount out-of-round.

Operators often try to straighten slightly crooked pipe by putting the lengths in the upper part of the string, where they will be under tension. Although seemingly they may straighten

drilling and servicing rig

—MAKES MORE PROFITS



The profit advantage of this "Cardwell" rig is its versatility. This combination rig can be equipped to do every kind of rotary or cable tool drilling and servicing job, and its performance is always outstanding.

Hundreds of operators have proved the "Cardwell" rig is a money-maker because of its fast operating speed, minimum haulage costs and low maintenance expense. There are three sizes of "Cardwell" combination rigs to fit your requirements. *Write for complete information.*

CARDWELL

REG. U. S. TRADE MARK PAT. OFFICE

THIS TRADE MARK INSURES HIGHEST QUALITY AT LOWEST PRICE

CARDWELL MFG. CO. INC.

P. O. Drawer 2001 . . . Long Distance Telephones 128—129—130

Cable Address: "ALL STEEL," Wichita — "CARDSTEEL," New York

Wichita, Kansas, U. S. A.

WHEN IT'S A "CARDWELL," THERE'S NO EQUAL IN QUALITY

enough to give no trouble in the upper part of the string, they are not being straightened entirely, nor permanently, and are still a menace if later allowed to get down near the drill collar.

9. Collapsed Pipe

a. From Drill-Stem Tests

In carrying out various formation tests, drill pipe is run empty in the well and set into the formation being tested before the valve at the bottom is opened. This subjects the bottom lengths to the full hydrostatic pressure of the drilling fluid, and has been known to cause collapse.

b. From Accidentally Running Pipe Empty

A case has been recorded of 5-9/16-inch drill pipe having been run to 7200 feet with a float collar, but the driller forgot to fill with mud while going into the hole. The bottom several joints collapsed, and resulted in a bad fishing job.

Ordinarily new drill pipe will withstand the external pressures usually encountered even in very deep wells, but if old and worn pipe or, what is more likely, if the pipe has been battered out-of-round, its collapse strength is reduced greatly. In the rare cases of collapse investigated by the writers, only old pipe was involved. The natural recommendation, then, is that any drill pipe run near the bottom of empty strings should be fairly new pipe, and should be examined carefully for any visible damage or out-of-roundness.

c. Tong- or Slip-crushed Pipe

Tong- or slip-crushed pipe hardly could be called collapsed pipe, but sometimes it is so classified. The causes and preventive measures are too obvious to need comment.

10. Eccentric Wall Pipe

In all of the writers' decade and a half of experience with drill pipe troubles, there has never been a case in any make of seamless drill pipe in which eccentricity of wall has been related definitely to a failure. Theoretically, of course, the strongest possible tubular section is one with perfectly uniform wall thickness, but the reduction in strength due to the allowable minimum of 12½ percent, or even more, under the nominal wall is only a very small factor as compared with other factors which cause drill pipe to fail. As an example, collapse tests made on pipe whose wall is carefully measured show no definite relation between eccentricity and collapse strength.

At least one large operating company, running its own drilling rigs, has a recorded case of trouble which it thought could be attributed to eccentricity. However, there were so many other factors involved that the true effect of the eccentricity was rather obscure.

11. Internal Erosion

Although there is a popular belief that mud can "erode" its way through drill pipe, without there being an original opening, there is no basis in fact for this theory. The idea is tied up with the word "washout" which, as stated earlier in this paper, is merely an eroded crack, which more properly should be called a "fatigue crack."

Drilling fluid, inside of drill pipe, does not have sufficient velocity to do any cutting, even in the restricted area under the tool joints, or upsets (in the case of internal-upset drill pipe). The fact that original mill scale can still be found in drill pipe, even after rather long service, is pretty good proof that the mud stream has very little cutting effect.

Below a critical velocity any fluid, especially a viscous one, moves in what is called "streamline" flow, in which the very center of the stream is moving fastest and with each succeeding "layer" of fluid moving less and less rapidly until at the inner surface of the conductor there is considered to be an infinitely thin layer having no velocity whatsoever. This theory, of course, would be true only for a tube of perfectly uniform inside diameter and with a perfectly smooth bore.

But, even with commercial drill pipe, the drilling mud follows "streamline" flow principles except, possibly, in very small pipe such as 3½-inch, or when the flow is through the tool joint and upset sections, in which cases the flow sometimes becomes turbulent.

Water courses in bits are the smallest areas through which the fluid passes, and do not cut appreciably with mud velocities around 100 feet per second, or with normal sand content in the mud. The maximum delivery through 4½-inch internal-upset drill pipe on the Gulf Coast approximates 500 to 600 gallons per minute, which gives maximum velocities of some 30 feet per second through the upsets, 27 feet per second through the tool-joint bores, and only 17 feet per second through the body of the pipe. Very evidently, then, there can be no possible cutting action with velocities so far below the approximate critical figure of 100 feet per second.

12. Magnetism

There has been much discussion from time to time concerning the significance of the magnetized condition of drill pipe. Nevertheless, to the best of anyone's knowledge, the magnetic condition has no effect whatsoever on the serviceability of the pipe.

CONCLUSIONS—DRILL PIPE

Inasmuch as the average contractor or operator is interested much more in the prevention of trouble than in its causes, the authors have summarized herewith the best-known practices, gleaned from all available sources, observed wherever wells are drilled by the rotary method. The preventive measures are listed more or less in the order of their importance; but, of course, what is quite important in one area may be of much less importance in another.

To Minimize Drill Pipe Troubles

1. Use sufficient weight in the drill-collar assembly to more than equal the weight carried on the bit, so that the drill pipe is always in tension. This practice is of highest importance in corrosive areas, to delay corrosion-fatigue failures. Also, it positively will prevent pure fatigue failures and will lessen notch-fatigue failures (from surface scars) in the non-corrosive rock-bit areas. It is of least importance in soft, fishtail areas, probably because the corrosion factor is at a minimum in such areas.

2. Keep the drill pipe straight, especially the lengths immediately above the drill collars. This, again, is of greatest importance in corrosive areas, but is highly important in any sort of drilling.

Keep a straightener on the rig, if necessary; and take care that drill collars, grief stems, and other such elements are straight. Optical instruments for checking the straightness of drill collars and grief stems are gaining favor, particularly in California.

Set the pipe as low as possible in the slips, to prevent crooking when making up or breaking out, and especially when using the automatic cathead. The smaller the pipe, the more easily it can be crooked by tonging, of course.

Run into the hole carefully, unless very free of obstructions, to avoid sudden hanging up of the bit, with possible crooking of the pipe.

Handle drill pipe with reasonable care while trucking, to avoid crooking, especially range 3 pipe; also while catlining into the derrick and when laying down for racking.

> It is now believed that range 3 drill pipe is entirely too flexible, especially in the sizes five-inch O.D. and smaller. Aside from the danger of crooking in transportation, it is hard to handle in the derrick, especially if handled in trebles, and may consume more lost time in racking, even with the use of a "belly board," than is gained by the lessened number of stands.

3. A very good practice, to insure against fatigue failures, is to move the

3 TIMES AS STRONG

AS THE PIPE THEY CONNECT!

Repeated tension tests prove that *Straight Grip* Tool Joints are THREE TIMES as strong as the drill pipe they connect! Testing has been done with the most modern machines in existence . . . and under the unbiased and impartial supervision of leading consultant and research engineering firms.

SIMPLIFIED Field Installation and Removal

Our new type, portable furnace has self-contained fuel unit. This and other new equipment developed by AMERICAN IRON makes for faster, easier field installation and removal!

bottom stand or bottom length of drill pipe just above the drill collar to the upper part of the string, and to keep doing this each time out of the hole. Then, if there is not quite enough weight in the drill-collar assembly, no one length of pipe will be run too long under bending fatigue conditions.

For many years it was thought that high-speed rotation was a very important factor in causing fatigue failures, especially in rock-bit drilling. Today it is recognized that speed is not limited nearly so much by the drill-pipe life as by the effect on other equipment, or by the over-all cost figures.

In Turner Valley, where the drilling is considered to be very hard because of the number of rock bits used, 150 rpm to 250 rpm is the average rotating speed, and it may run above 400 rpm. In California one large operator considers 300 to 350 rpm to be an economical speed, and speeds higher than 500 rpm, and even 600 rpm, have been tried. In neither of these areas are there any alarming drill pipe troubles.

However, as previously stated, it is suspected that there are some critical speeds which will give undue whipping, and resultant fatigue; but there seems to be no way of calculating what they are.

4. Avoid transverse scars on the pipe, as they are an exceedingly frequent cause of notch-fatigue failure. In some areas, particularly in hard rock-bit drilling, this is the most common cause of all drill pipe failures, even in rather new pipe.

Use finely serrated spider slips, never the old-type which makes sharp-bottomed circumferential grooves on the pipe.

Never allow drill pipe to turn in the table slips, but use backup tongs when there is insufficient drill pipe hanging in the hole. If the pipe is rotated, momentarily, with the table slips, be sure that it cannot turn and be scarred by the slips, even though they are of the best modern design.

Drill pipe should not be steel-stencil-stamped, except with especially designed stencils, and *never* marked with an electric arc.

Not much can be done to prevent scarring from rock-bit teeth and many other causes but, at least, such lengths can be discarded or degraded to less important drilling. Some scars can be filed off, which should be done with *longitudinal* file strokes.

5. Corrosion fatigue can be eliminated by chemical treatment of the mud, but ordinarily this is considered too expensive. Pending further study of the treatment of the drill pipe itself, at the mill, only a few helpful recommendations for care in the field can be made.

The most important, already mentioned, is to run enough drill collar weight so that the drill pipe always will be in tension. This at least will remove the bending-fatigue part of the trouble, but it still leaves the corrosion part.

A possible help in decreasing the corrosion phase of the trouble would be to drill with heavier mud. Colloidal mud minimizes corrosion, but there has been only little field study of this suggestion.

A more definite help in minimizing corrosion is to keep the drill pipe free from the corroding formation salts while out of the hole. At least it is quite simple to flush out the inside of the pipe while racking the pipe between wells.

Another suggestion, but not a preventive of corrosion fatigue, is to inspect the pipe at fairly frequent intervals. This particularly means internal inspection to search for corrosion pits which are proceeding into transverse cracks, and it means also the discarding of lengths showing even the smallest of such cracks.

A service is available today which cleans the inside of the pipe with a wire brush, after which the inside surface can be viewed by a very ingenious optical method.

By this method it is sometimes possible to distinguish between ordinary shallow corrosion pits and those which are becoming transverse cracks, but the value of this service, for this particular purpose, involves great skill on the part of the observer.

The final conclusions of the corrosion fatigue study made by the Battelle Memorial Institute for the American Association of Oilwell Drilling Contractors are well summarized in the May, 1948, issue of WORLD OIL. On page 136 of this issue R. C. McMaster (Battelle) lists the following "Drilling Recommendations:"

1. Use sufficient drill collar weight to keep the entire drill string in tension. This lowers bending stress in the pipe, eliminating column distortion caused by compression load.
2. Use a separate drill string for the salt beds. The most severe corrosion occurs with brine or sea water as a drilling fluid. Use a different string of pipe in good condition for deep, hard-rock drilling in fresh water muds, after the salt beds are cased off.
3. Provide protective coating (as of plastic) for the interior surface of the pipe. While intact, the coating will provide complete protection of the critical interior surface from corrosion. Coatings cannot be maintained on the external wall of drill pipe because of abrasion against the wall of the hole.
4. Use 2500 parts per million sodium chromate inhibitor in drilling fluids. Combine this procedure with other good practices for optimum benefit.
5. Avoid salt contamination in fresh-water drilling fluids.
6. Clean drill pipe thoroughly to remove corrosion products, at reasonable intervals prior to inspection, to improve reliability of inspection and to enhance effectiveness of inhibitors.
7. Inspect drill pipe carefully at reasonable intervals, rejecting for use in deep drilling all joints containing fatigue cracks or severe stress concentrations.
8. Combine above practices, insofar as economically practical, to obtain increased benefits.

The above list of recommendations conforms very closely to those which have been advocated for some time by drill pipe manufacturers to minimize drill pipe trouble.

6. Suggestions for preventing trouble from worn pipe, collapsed pipe, pipe which has been fished out, etc., are almost too obvious to need mention in this summary. Here, again intelligent inspection between wells often can avert failures and costly fishing jobs.

The inspection well might be done whenever the string is laid down for tool joint repairs or replacement. The pipe should be examined especially for crookedness, eccentric wear, slip marks, and all other sharp-bottomed surface scars.

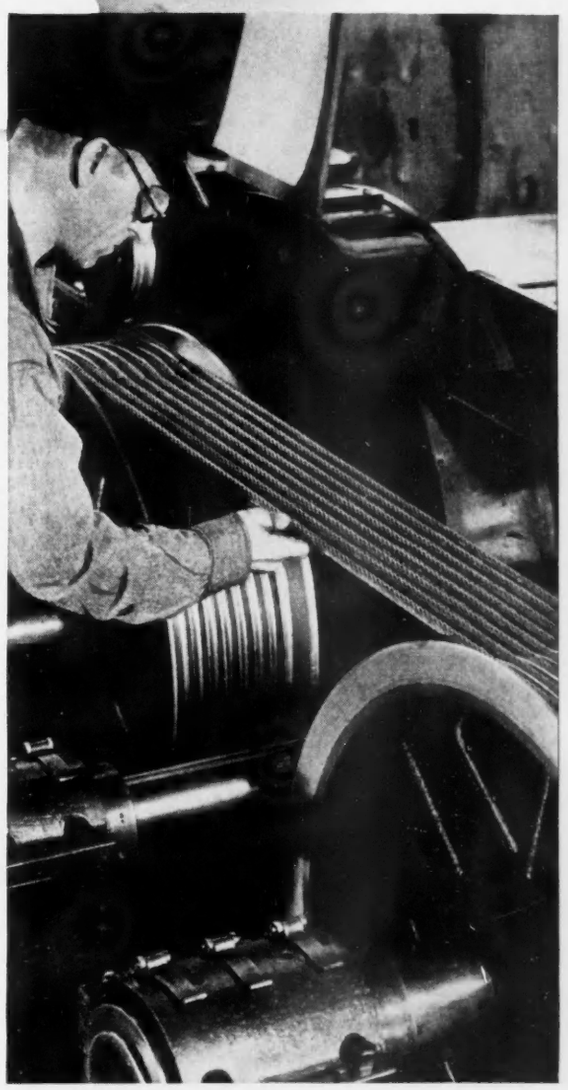
Lately, magnafluxing the external surface of drill pipe, between wells, has been successful in revealing incipient transverse cracks, especially near upset runouts (from pure fatigue) and in slip or tong marks. Such service is now available in the field.

Also, a gamma ray method of finding dangerously thin walls, either from eccentric wear or excessive corrosion, is showing some sign of practical utility in the field.

7. When conventional API tool joints

How do we keep wire rope customers

How do we make new ones



The only way we do either is by furnishing a quality product—one worth every penny we charge for it.

Every one of the many major improvements in our mill during the past ten years has been made with one object in mind—*to increase the quality, the service life, of the finished rope.*

This isn't just sales talk. In the highly competitive oil-country business, our wire rope wouldn't stand a chance if it weren't a fine product. It is—as fine as you can buy—and the strongest evidence is the growing tonnage of Bethlehem rotary lines sold each year.

Now that it is possible to compare and evaluate rope performance by ton-mile records, more and more drillers are swinging to Bethlehem. If you haven't yet tried one of our rotary lines, we suggest you put one on—then check the job it does. There's a size and type for every rig, large or small, land or marine.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Export Distributor: Bethlehem Steel Export Corporation

When you think WIRE ROPE
... think BETHLEHEM

are screwed onto API drill pipe, the work should be done in a properly equipped shop. The threads should be cleaned carefully, lubricated adequately with a good quality of thread lubricant, and the joints should be made up at the proper number of revolutions per minute. Some torque-measuring device should be used to insure that the joints are screwed on with proper tightness to prevent leakage. Then, especially for rock-bit drilling, the tool joints should be welded to the pipe to insure against last-engaged thread failures. The welding should be done *before* the pipe is ever put in service. After thread failures have started to occur the welding will not always prevent cracks which have barely started from going on to complete failure in spite of the later reinforcement of the weld metal.

8. The mud pressure gauge should be watched very carefully, during drilling. Any slight drop in pressure may indicate that a failure is just getting started; thus the pipe often can be pulled out of the hole before the crack proceeds to a complete break.

Instruments currently are being developed which automatically can give warning of very small cracks in the pipe or of leaks in the tool joints. One method is tied up with a continuous mud-analyzing service which successfully has predicted a number of pipe failures early enough to get out of the hole (J. T. Hayward).[3]

9. Stuck pipe never should be pulled beyond its yield point, except as a last desperate measure. The yield-strength figures for the various sizes, weights, and grades are furnished by the manufacturers; but before these figures are even approached, all known methods of freeing stuck strings should be tried. Some references to papers on this subject are given in the bibliography of this paper.

REFERENCES

[1] V. V. Mason, "Drill Pipe Corrosion," Am. Inst. Mining Met. Engrs., Los Angeles Meeting, Oct. 1940.

[2] J. T. Hayward, "Continuous Logging at Rotary-Drilling Wells," *Drilling and Production Practice*, 8 (1940).

[3] J. T. Hayward, "Cause and Cure of Frozen Drill Pipe and Casing," *Drilling and Production Practice*, 8 (1937).

[5] L. R. Smith, "Abuse in Handling Tubular Goods," *Drilling and Production Practice*, 279 (1937).

[6] J. T. Hayward, "Methods for Determining How Much of a Frozen or Cemented Column of Pipe Is Free," *Drilling and Production Practice*, 16 (1935).

[7] H. W. Graham, "The Development of Rotary Drill Pipe," *Drilling and Production Practice*, 162 (1935).

[8] F. N. Speller, "Corrosion Fatigue of Drill Pipe," *Drilling and Production Practice*, 239 (1935).

[9] J. E. Brantly, "Rotary-Drilling Practices," *Drilling and Production Practice*, 13 (1936).

[10] S. T. Sikes, Jr., "Drilling Speeds," *Drilling and Production Practice*, 54 (1936).

[12] J. E. Warren, "Causes, Preventions, and Recovery of Stuck Drill Pipe," *Drilling and Production Practice*, 30 (1940).

[13] H. R. Copson, "Galvanic Corrosion of Dissimilar Metals in Salt-Water Solutions," *Drilling and Production Practice*, 219 (1940).

[13] Report of Special Subcommittee on Corrosion Fatigue of Drill Pipe, *Proc. API* **20 [IV]** *(Production Bull. 224)* 109 (1939).

[14] W. C. Shutts, "Recent Developments in Joint Designs of Tubular Goods," *Drilling and Production Practice*, 132 (1934).

[15] Reports by Battelle Memorial Institute as published in *The Drilling Contractor*, official publication of the American Association of Oilwell Drilling Contractors, through the years 1946, 1947, and 1948.

[16] Plastic Coating Inside Surface of Drill Pipe to Combat Corrosion Fatigue Failures, by L. E. Trishman, *The Petroleum Engineer*, November, 1946.

[17] Inhibition of Drill Pipe Corrosion. Abstract of W. H. and L. D. Betz report by H. G. Texter, in *Drilling Magazine*, May, 1946.

Discussion

Walter C. Main (Youngstown Sheet and Tube Company, Los Angeles, Calif.) (written): The authors are to be congratulated on a very constructive and well written paper. It leaves practically nothing for a commentator, even a competitor, to pick on.

I should like to see everyone here and everyone else who has access to this paper make sure that all of their friends among the drillers, too pushers, and drilling superintendents read it, argue about it if necessary, but by all means make sure that the precautions to minimize troubles which the authors urge are observed.

If I may be permitted to try to add something to what the authors have said, I would call your attention to the subject of "Crooked Pipe" under heading No. 8, in which the authors mention the possibility of kinking the pipe through violent vibrations. In California we seem to have been harassed by pipe becoming crooked for no good reason at all, unless it was from vibrating in a violent manner. The pipe was known to be straight when run into the hole, the driller had plenty of weight in his drill collars, no bridge nor other obstruction was run into on the way in, and the pipe was big and heavy enough and set close enough to the table to make it impracticable that it could become kinked by tonging. Furthermore, the kelly and collars were straighter than than usual, and all threads were in good alignment.

As the authors point out, it is not possible to make a strictly accurate mathematical analysis of critical speeds, because there are so many variables. These critical speeds are affected by the mud weight and its viscosity, by the weight of the drill collar and the proportion of this weight resting on the bit, as well as the size and weight of the drill pipe and its tool joints.

There is one thing that could be done, however, which usually helps: and that is to make frequent actual determinations of critical speeds in the hole. If the driller has his hole in good shape so that there is no danger from shutting down the pumps for a few moments, all that need be done is to pull the bit just off bottom, start rotating slowly, and increase the rotating speed uniformly until the torque gage shows a sudden marked increase. This procedure makes it possible to find the speed to avoid for the particular conditions existing at the time. It is much easier to find this bad speed with the pumps down, because the heavy stream of mud in motion has great "damping power." However, this bad speed can be detected with the pumps going, particularly after it has once been found with the mud stream stopped.

From a mathematical point of view, any single length of pipe can be considered as a flexible shaft which has a critical speed expressed by the following equation:

$$RPM = \frac{4{,}760{,}000}{L^2} (D^2 + d^2)^{1/2}$$

Where:

RPM = critical speed, revolutions per minute.
L = length of one joint, inches.
D = outside diameter of pipe, inches.
d = inside diameter of pipe, inches

This formula neglects the mud weight and the suspended load, but the effect of the suspended weight is to increase the critical speed, and the effect of the mud weight is to decrease it. As the mud weight and viscosity are substantially constant for long distances in the oil well, the net effect of these two variables is that the critical speed increased from the bottom of the hole to the top due to the ever-increasing suspended load. Nevertheless, this change is small enough so that if a few joints of pipe get into a condition of resonance, this will force neighboring joints into a condition of resonance also, and the pipe for some distance will swing in nodes which drag on the walls of the hole and cause the marked increase in torque mentioned previously. Critical speeds, however, calculated from the foregoing formula, depend on the length which varies for several feet and the wall thickness which varies by several percent. Therefore, as we cannot predict which particular joint of pipe starts the trouble, this calculated value may vary from the speed found by testing by as much as 10 or 15 percent, which proves the authors' contention that an accurate mathematical analysis is impractical, but does have the practical aspect that if the driller will stay about 15 percent away from this critical speed, he should reduce his troubles.

We are indebted to Charles Yateman of the Shell Oil Company, Inc., California, for a little more mathematics on this problem. He found that, when the

Cementrol

. . . PROTECTS AND PREVENTS CEMENT CONTAMINATION OF EXPOSED FORMATIONS BELOW THE CASING SEAT

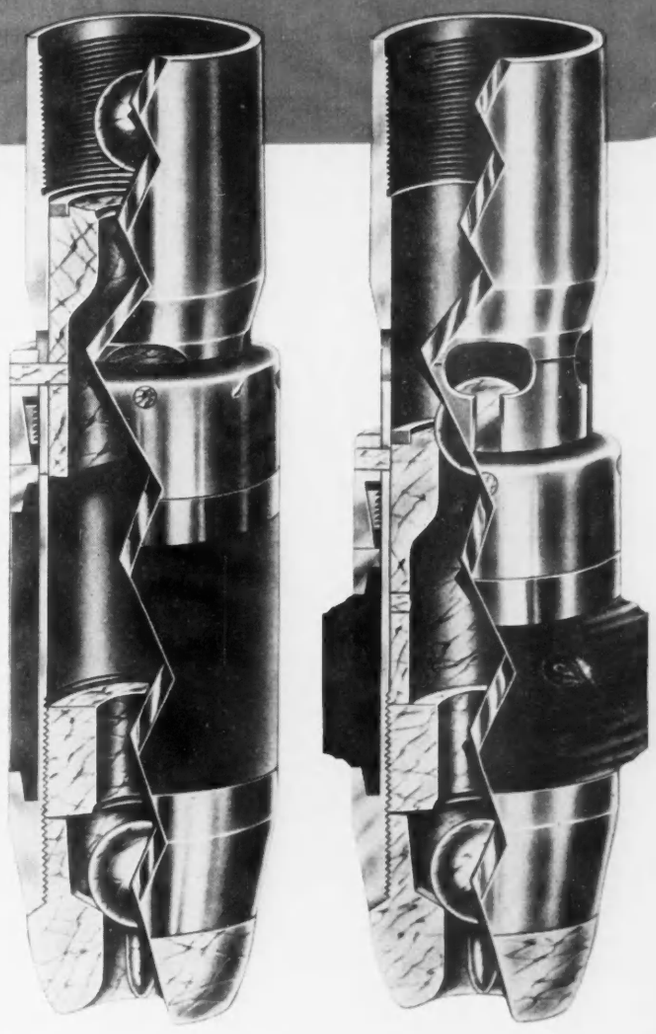
Cementrol is the tool to use when it is imperative that no cement pass below the casing seat. It was developed specifically for this purpose, and is now being effectively used in wells of all depths.

Cementrol is "made to order" for water-flooding operations where it is so necessary to keep the open hole of input wells free of pore-clogging contamination.

In addition to preventing contamination of the formation, Cementrol, as the packer expands under hydraulic pressure, provides a positive centering of the casing at the shoe, and assures an even flow of cement that is discharged through the side ports.

For complete information on the operation, and the various applications of Cementrol equipment, please refer to your Larkin catalog . . . or call your nearby Larkin representative.

Cementrol is stocked by all leading supply stores.



Cementrol in running-in position . . . serving only as a float shoe.

Cementrol after being expanded by pump pressure. Note external packer, internal bakelite bridge, and exposed side cementing ports.

LARKIN

...Through Your Supply Store

LARKIN PACKER CO., INC.

ST. LOUIS, MO.

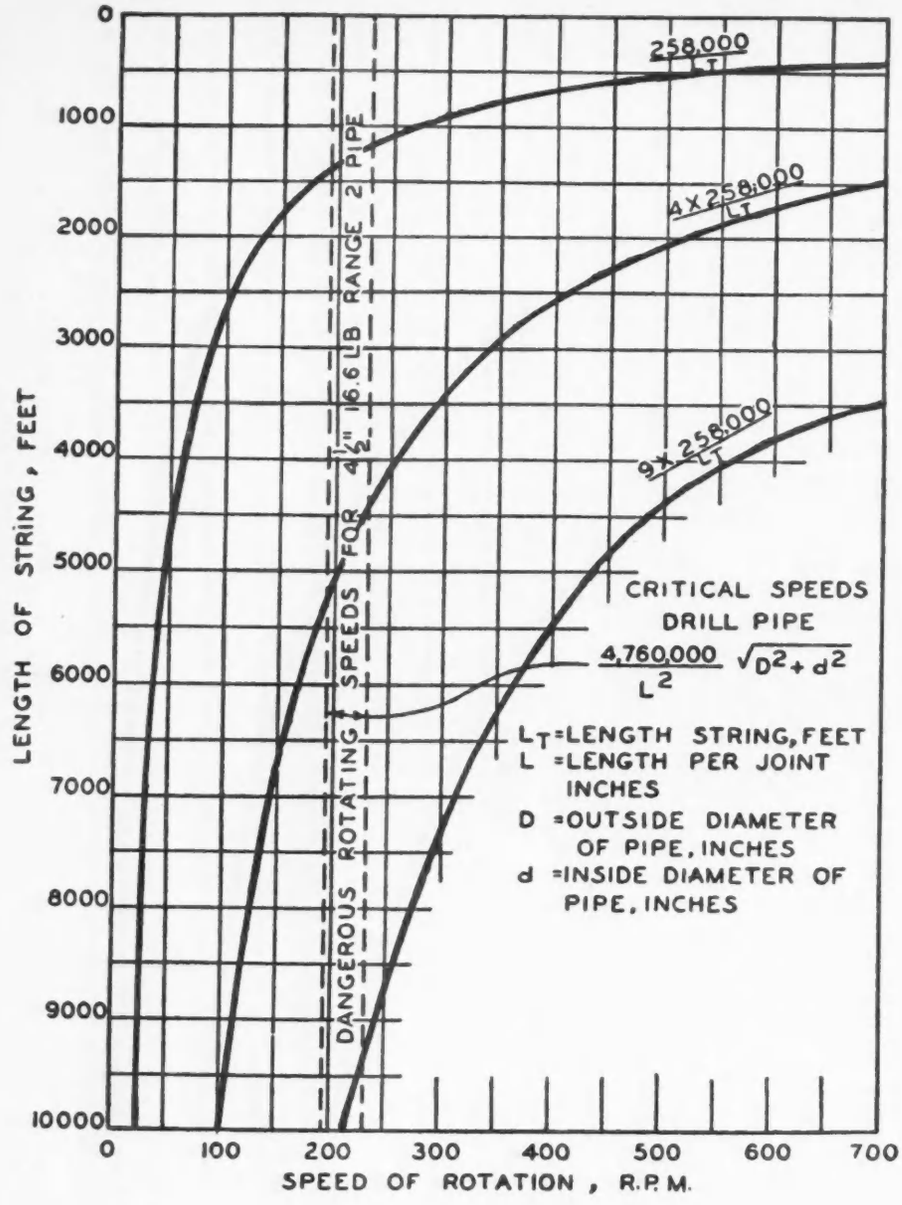


FIGURE 1. (By Main.)

critical speed mentioned previously was the same speed which would result from the application of a "spring pendulum" formula to the drill stem, the results were particularly bad and produced serious kinking. Mr. Yateman's formula is a simple one:

$$\text{RPM} = \frac{258{,}000}{\text{entire length of string (feet)}}$$

The constant, 258,000 is based on mud whose density is 1.15, approximately, i.e., 72 pounds per cubic feet or 9.6 pounds per gallon, and should be varied to suit the particular mud in question. It should be noted that this critical speed is independent of the size or weight of the drill pipe. Therefore, it applies equally well to the entire range from 2⅞ inches to 6⅝ inches pipe. It also neglects the added weight of the tool joints and drill collar, which would tend to decrease the critical speed somewhat; but, again, this change is of such small actual value that the 15 percent mentioned previously will cover it amply. In addition to the speed given by Yateman's formula, there are secondary and other higher frequencies which should be taken into account. These vary as the squares of small whole numbers; for example, the secondary critical speed is 4 times the primary speed, and the next one is 9 times the primary speed and so on through 16, 25, 36, etc. In Figure 1 (Main) are shown three of these critical speeds; superimposed on them is the zone of critical flexible shaft speed that could be expected when range 2, 4½ inch × 16.6 pound drill pipe is run.

Among the authors' preventative measures, therefore, we should like to suggest the addition of avoiding these critical speeds; and, although the foregoing formulas may give some idea of where to find these critical speeds, the best way is by actually making frequent tests in the well.

It could be argued that either one of these critical speeds alone could be imposed on the pipe without undue harm. The critical speed from a flexible-shaft point of view occurring alone would tend to increase greatly the wear on the pipe, and would increase the bending stresses which might result in last-engaged thread and other types of fatigue failures. The speed which would result in resonance of the drilling string as a "spring pendulum" might produce some bouncing without serious results; but, when the drill pipe is vibrating in nodes and becomes wound up like a helical spring, kinking can and does occur. Many operators are successful in getting past these critical speeds, and there probably is no more harm in drilling faster than slower—provided, of course, that one is successful in avoiding the violent vibration that occurs at this point.

(To be continued next month)

Here's why you get Better Performance and Longer Life with an EMSCO Slush Pump

FABRICATED STEEL POWER END. Fabriform construction provides an extremely rigid, strong and compact unit. Steel skids, built integral with the power frame, considerably reduce pump weight and overall dimensions.

ECCENTRIC ASSEMBLY. One piece eccentric strap equipped with roller bearings at both ends assures quiet, efficient and trouble-free operation. Entire assembly is flood-lubricated from main oil bath.

GEARING. Forged alloy steel herringbone gears maintain perfect axial balance and provide quiet and efficient speed reduction. Two-piece main gear mounted on self-aligning roller bearings.

LUBRICATION. All running parts flood-lubricated by a positive-splash system, eliminating troublesome oil pumps and grease connections. Large diameter, high-capacity roller bearings assure long, trouble-free operation.

CROSSHEADS AND GUIDES. Hard chrome-plated heat-treated steel crossheads run on renewable guides. Heavy duty needle roller bearings used in crosshead pin assembly.

STUFFING BOX COMPARTMENT. Piston rod connects to crosshead extension in large, open compartment for easy piston rod replacement. Power end fully protected against intrusion of mud.

"EXPOSED" LINER. Fluid liners packed off at both ends and exposed to view. This patented construction permits immediate and unfailing detection of mud leakage before serious washouts can occur. Liners can be easily removed as they cannot become locked by sand.

DIRECT FLOW DESIGN. Full openings and large passages permit free, unobstructed fluid flow. This direct flow design assures low fluid velocities and highest volumetric efficiency.

CAST STEEL FLUID END. Electrically welded, cast-steel fluid end provides maximum strength with minimum weight. The all steel construction of the fluid end permits repairs to be made in the field by the utilization of welding.

EMSCO

REG. U.S. PAT. OFF.

EMSCO DERRICK & EQUIPMENT COMPANY

Houston, Texas LOS ANGELES, CALIFORNIA Dallas, Texas

D-E

"PACEMAKERS IN OIL FIELD EQUIPMENT DESIGN"

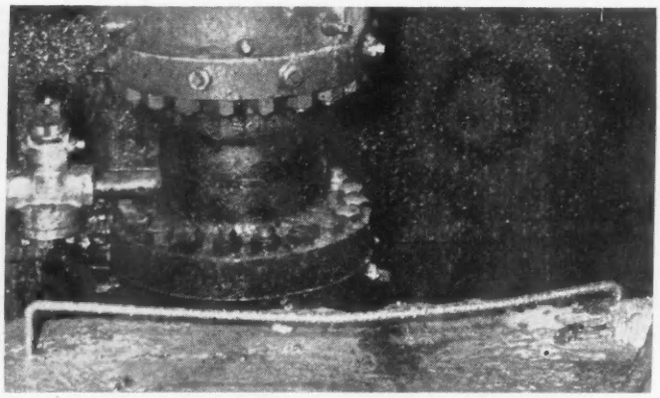
DRILLING HINTS

How to do it!

$10 is paid for each illustrated acceptable contribution. Mail to The Editor, WORLD OIL, P. O. Box 2608, Houston 1, Texas

HOW TO—Provide Supporting Rail Around Concrete Cellars

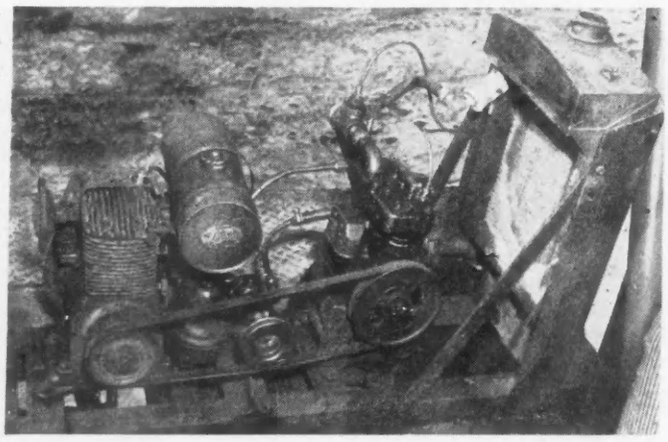
When drilling wells to depths exceeding eight or ten thousand feet, many companies make it a practice of pouring heavy, steel reinforced concrete cellars prior to erecting the derrick. These concrete cellars have proven themselves where the drilling program has extended over periods of sixty days or more during which time much testing and work is required in the cellar and beneath the floor in changing hookups.



The job of working on well head equipment located in the cellar can be facilitated by adding a supporting rail on all four sides of the concrete opening. Purpose of these rails is to aid crewmen in getting in and out of the cellar when it is necessary to bolt up casing spools and spot other well head equipment in position. Because the edge of the concrete boarding the cellar becomes muddy and oily, it is difficult to grasp for support. By providing the railing as shown, support may be obtained by holding to one of these railings when going into or getting out of the cellar. Each rail boarding all four sides of the cellar is merely a section of ¾-inch steel rod material which has been bent and set in the wet concrete when the cellar is under construction. The cost is slight; the convenience and added safety value is relatively large.

HOW TO—Construct Small Air Compressor from Salvaged Parts

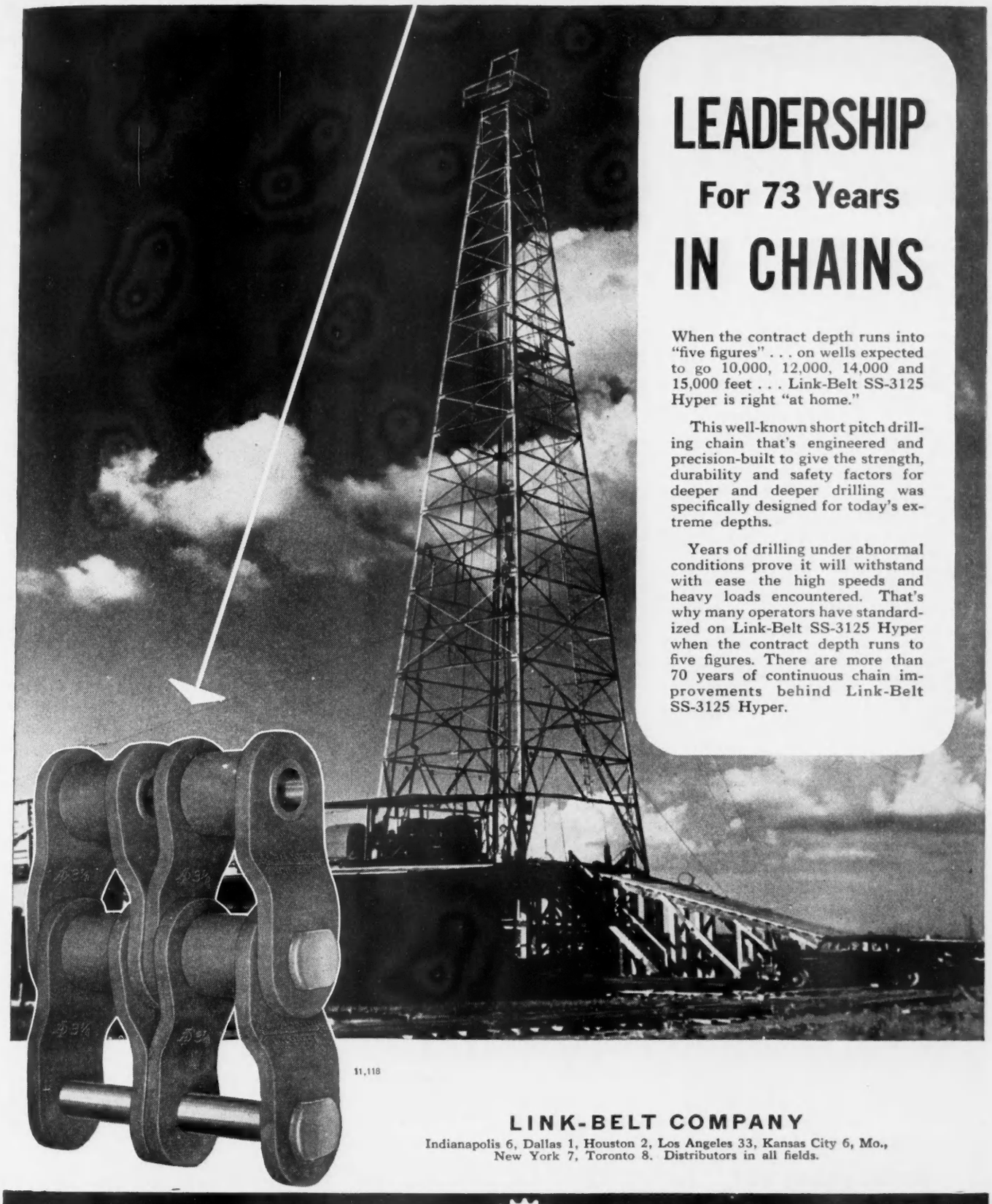
Utilizing a two-cylinder air compressor salvaged from a discarded machine, a shop foreman fabricated the small unit illustrated. Parts required to assemble the complete compressor were a one-cylinder, air-cooled, gasoline engine, an old water pump and pulley, small radiator, angle iron and piping.



Base for the unit was made from two-inch angle iron welded into a frame measuring 4 feet by 18 inches. Cross pieces on which to bolt the individual parts were added. The salvaged radiator was mounted inside two supported six-inch angle brackets which formed a bumper guard.

The prime mover was bolted securely in place while the air compressor itself was hinged as shown so that it tilted slightly forward. When equipped with the proper size V-belt, this slight tilt of the compressor provided constant tension on the belt. A salvaged automobile water pump with an extended shaft was mounted between the compressor and the engine. A four-inch pulley rides on the V-belt to drive the water pump whenever the engine is running. This water pump provides continuous circulation of water from the lower connection on the radiator through the air compressor and back into the top of the radiator. Cooling capacity of the radiator makes it unnecessary to force air through the radiator.

Air is delivered into a receiving tank where a pressure pop valve has been installed. A back-pressure valve was mounted in the pressure line from the compressor to the storage tank to prevent the air from escaping back into the compressor when the unit was shut down. This shop-made unit has supplied one medium-depth rig with sufficient air for the operation of all air controls.



LEADERSHIP

For 73 Years

IN CHAINS

When the contract depth runs into "five figures" . . . on wells expected to go 10,000, 12,000, 14,000 and 15,000 feet . . . Link-Belt SS-3125 Hyper is right "at home."

This well-known short pitch drilling chain that's engineered and precision-built to give the strength, durability and safety factors for deeper and deeper drilling was specifically designed for today's extreme depths.

Years of drilling under abnormal conditions prove it will withstand with ease the high speeds and heavy loads encountered. That's why many operators have standardized on Link-Belt SS-3125 Hyper when the contract depth runs to five figures. There are more than 70 years of continuous chain improvements behind Link-Belt SS-3125 Hyper.

11,118

LINK-BELT COMPANY

Indianapolis 6, Dallas 1, Houston 2, Los Angeles 33, Kansas City 6, Mo., New York 7, Toronto 8. Distributors in all fields.

PENBERTHY
Drilling Hints

Drilling contractors have long found that it pays to standardize on Penberthy products because of their exceptionally rugged construction and their dependable performance under the most severe operating conditions.

PENBERTHY INJECTOR

Penberthy Automatic Injectors are the accepted method of assuring an uninterrupted supply of feed water to boilers at minimum cost. They are quickly and easily installed—require little attention.

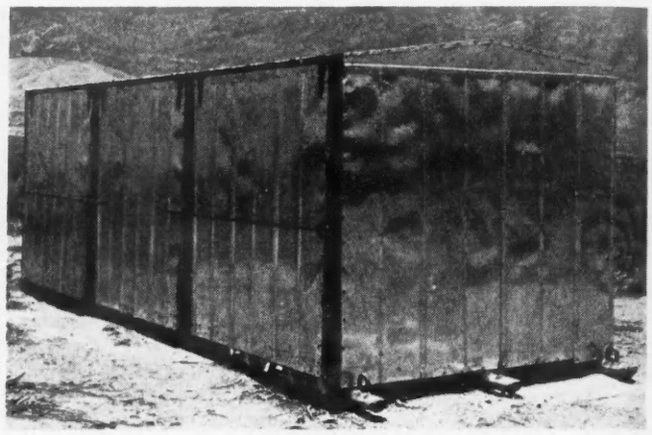
PENBERTHY "Reflex"
WATER GAGE SET

Water level cannot be misread because steam always shows white and water black. U-Bolt construction permits replacing glass by simply removing nuts on face of gage... unnecessary to work between gage and boiler. 3277-D

PENBERTHY INJECTOR CO.
Detroit 2, Mich.
Canadian Plant — Windsor, Ontario

HOW TO—

Build Easily Locked Portable Core House



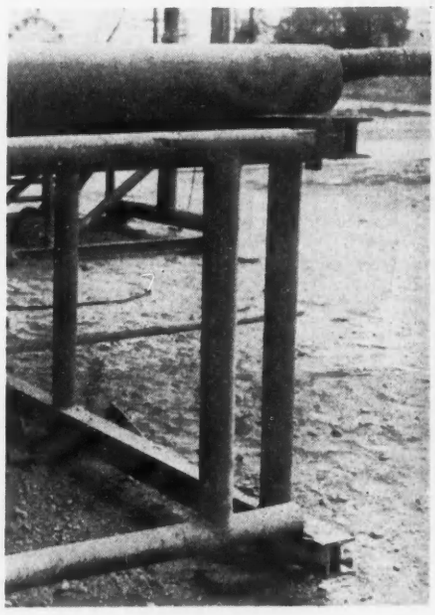
A portable, skid-mounted core house that is easily moved from one location to another, yet has ample capacity to serve a number of wells, is employed by a major operating company. Built on a three-runner base of salvaged pipe, the house has three compartments, the door of each being hinged at the top so that during regular use the door can be raised and used as a shade or shelter.

A novel and effective means of locking the house is illustrated. Four steel ears are welded to the front corners and to the two vertical supports between the doors. Two steel rods are run through the ears as shown, their lengths being sufficient to overlap the two outer doors and extend over on the inner door. This arrangement effectively bars all three doors and requires that only two padlocks be used, the locks being run through holes in the projecting ends of the two rods.

The building is roofed and covered with sheet aluminum panels, a material that is easily installed and requires little maintenance or upkeep, yet which adds little weight to the portable structure.

HOW TO—Construct Simplified Pipe Racks

A simplified type of pipe rack employed by one drilling contractor is of such a design that a minimum of internal bracing and supporting members is required. Partly shown in the accompanying photograph, the transverse sections of the rack consist of an upper and lower member of H-beam structural steel, short lengths of drill pipe being welded vertically between them to form rigid trusses.



The trusses are anchored to the walkway at one end, and at the outer end, by a simple rectangular structure made of drill pipe. The latter, as can be seen at the corner post, is attached to the H-beam members by clips which drop into matching slots. The clips project below the slots, permitting a pin to be run through a hole drilled through the exposed ends of the clips, preventing the locking truss from being pulled out accidentally. Each of the rack members thus is rigidly supported.

When disassembled, the rack members may be stacked flat, with consequent savings in trucking costs between locations.

THE *New* GUIBERSON TYPE J DRILLING HEAD

with FULL-FLOATING WASHPIPE

Increased load-carrying capacity... the ideal tool for drilling-in, reverse circulation and clean-out operations.

Check these improved features!

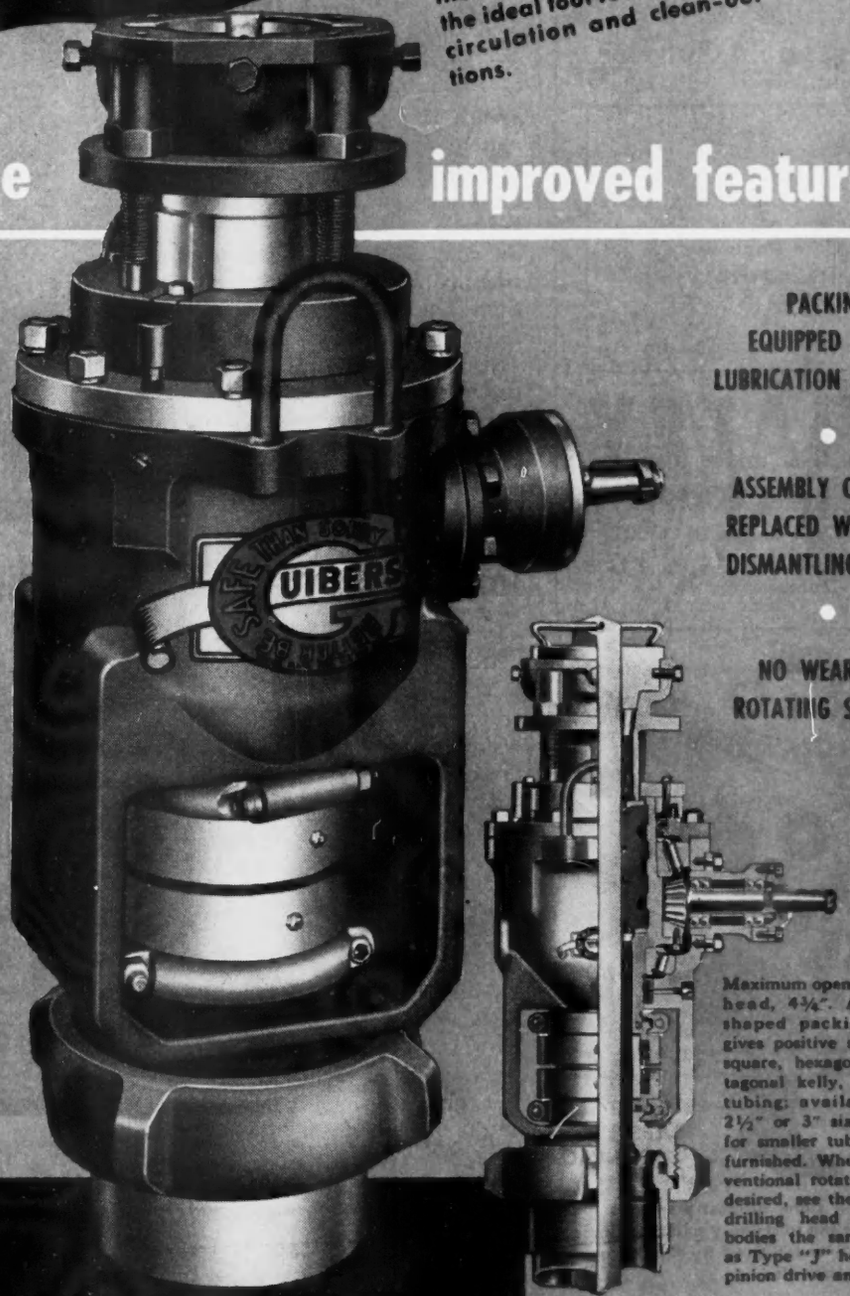
WASHPIPE PACKING ASSEMBLY IS TAMPER-PROOF

NO ADJUSTMENT REQUIRED AT ANY TIME

ROTATION IS IN EITHER OR BOTH PACKINGS FOR LONGER PACKING AND WASHPIPE LIFE

NO MUD OR DRILLING FLUID CAN ENTER HOUSING

REINFORCED HEAD WILL NOW HANDLE TUBING STRINGS UP TO 8,000 FEET IN DEPTH



PACKINGS EQUIPPED WITH LUBRICATION FITTINGS

ASSEMBLY CAN BE REPLACED WITHOUT DISMANTLING HEAD

NO WEAR ON ROTATING SPINDLE

Maximum opening through head, 4¼". Accordion-shaped packing rubber gives positive seal around square, hexagonal, or octagonal kelly, as well as tubing; available in 2", 2½" or 3" sizes; rubbers for smaller tubing can be furnished. Where the conventional rotating head is desired, see the Type "K" drilling head which embodies the same features as Type "J" head without pinion drive and gear.

For detailed information on the Guiberson Type J Drilling head, write or call the Guiberson office nearest to you.

SAFE WHEN SORRY GUIBERSON WESTERN DE

Reg. U. S. Pat. Off.

Guiberson U.S.A.

THE GUIBERSON CORPORATION

DALLAS, TEXAS — ESTABLISHED 1919

California Distributor: The W. R. Guiberson Co., 717 East Gage Avenue, Los Angeles 1. Export Office: 30 Rockefeller Plaza, New York City 20.

Branch Offices in Oklahoma City and Tulsa, Okla.; Longview, Kilgore, Houston, Alice, Odessa and Wichita Falls, Texas; Lafayette, Louisiana; Wichita, Kansas; and Newark, Ohio.

© 1948, The Guiberson Corp.

BIT CUTTING ANALYSIS
(New Technique)
PERMEABILITY
Porosity and Saturation Data from Reverse Circulation Bit Cuttings
•
Oil in Place, **Connate Water** by Restored State Method
•
Analysis of Oil Field Brines
•
Core Analysis
•
Secondary Recovery
•
Petroleum Production Engineers

WHALEY ENGINEERING COMPANY
PETROLEUM LABORATORIES
118 W. Cameron, Tulsa, Okla. Ph. 2-1955

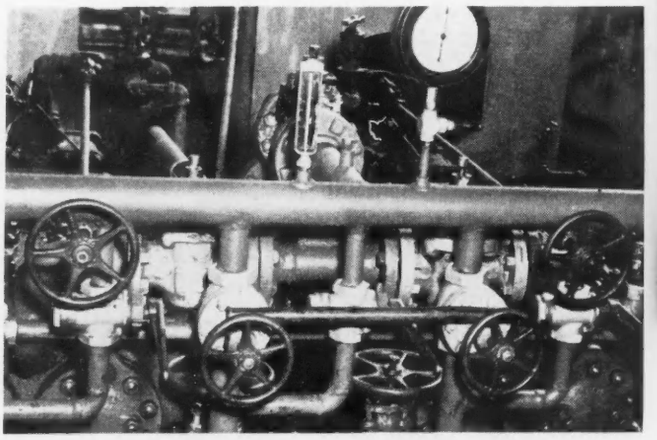
GERONIMO
FOR THE SAFETY OF YOUR MEN
DERRICK ESCAPE MECHANICISM
NET WEIGHT 15 LBS.
GLIDE TO SAFETY ON GERONIMO (Patent Applied For)
GERONIMO will stand hardest wear and give unfailing protection to refinery and derrick men whose lives are endangered by fire, escaping gases or other hazards.
EASILY ATTACHED OR REMOVED
EXTRA STURDY CONSTRUCTION
QUICKLY STRADDLED
POSITIVE, INSTANT BRAKE
BRONZE "No-Spark" SURFACES
RECOMMENDED FOR ½" WIRE LINE
• Write for Illustrated Folder •
SOLD THROUGH YOUR SUPPLY STORE
— MANUFACTURED BY —
CHARLIE'S MACHINE WORKS
PERRY, OKLAHOMA

HOW TO—Set Up Portable High Line Dead Man

Saving considerable time and effort at each new location is the simplified high line post utilized by one drilling contractor. It consists of a length of drill pipe set in a slightly larger socket, the latter embedded at a slight angle, in a large block of steel reinforced concrete. The block, measuring approximately six feet long by three feet wide and a foot thick, is equipped with a pair of lifting eyes to facilitate transporting between locations. Weighing between one and two tons, the block will handle the majority of loads carried by the high line. The broad surface of the block provides considerable friction and resistance to movement along the ground. The ease with which the block may be picked up, hauled, and re-deposited at the next location, more than pays for its building cost.

HOW TO—Group Controls on Boiler Feed Pump

In recent years, the trend in steam generating plants for drilling rigs has been toward automatic controls. Once the boilers are fired, the fireman on a modern steam rig has merely to check all operations periodically during his tour to insure their proper working condition. However, with all the automatic control equipment found on the modern steam



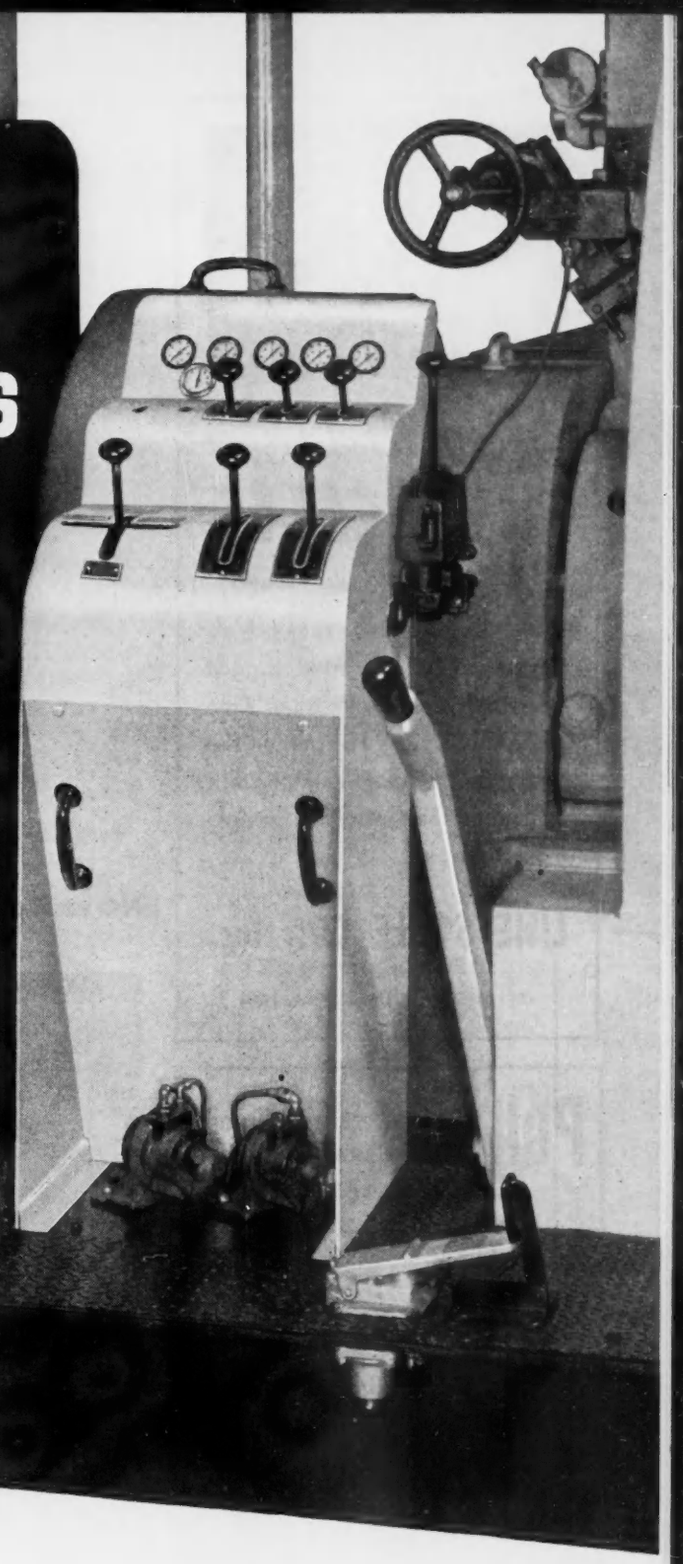
Inside, some lucky oil man is enjoying the most comfortable night's sleep he ever had.

LOMA ALTO • LAWN | LAKEWOOD HOTELS
4518 LEMMON • 3718 LEMMON | 1818 ABRAMS RD. • DALLAS

No more wrestling with clumsy levers

A touch of the hand and it's done

THAT'S BETHLEHEM FINGER-TIP CONTROL



No longer need drillers push, tug, haul and shove, grunt and groan. With the advent of Bethlehem Finger-Tip Control, the ancient struggle between man and levers became a thing of the past.

These new feather-touch air controls—all within inches of the driller—now feature *every* Bethlehem drilling rig. For more hole—*faster*—get Finger-Tip Control!

BETHLEHEM SUPPLY COMPANY

General Offices: 21 E. Second Street, Tulsa, Okla.

Subsidiary of Bethlehem Steel Corporation

BETHLEHEM STEEL

20 Models

LINE SCALES

40,000 to 500,000 Lbs. Capacity!

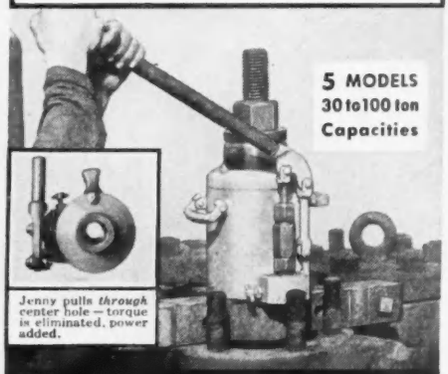
Widely used because they are always accurate, sensitive, rugged —and economical. With a Line Scale you KNOW the pull on the line, and the weight on the bit, in pounds! See your local supply man for details.

LINE SCALE CO., Inc.

907-11 SE 29th, Box 4245, Phone 6-1765

OKLAHOMA CITY, OKLAHOMA

Pulls VALVE SEATS, PINIONS GEARS, WHEELS *FASTER - EASIER*



SIMPLEX-JENNY

CENTER-HOLE HYDRAULIC PULLER

The Simplex-Jenny uses hydraulic power—without torque—for quick pulling of valve seats, gears, wheels—scores of other jobs. Operates in any position; light weight, quickly set up. Also serves as press or conventional heavy-duty jack. For complete specifications, prices, send for Bulletin: 47J.

Simplex LEVER • SCREW • HYDRAULIC Jacks

TEMPLETON, KENLY & COMPANY

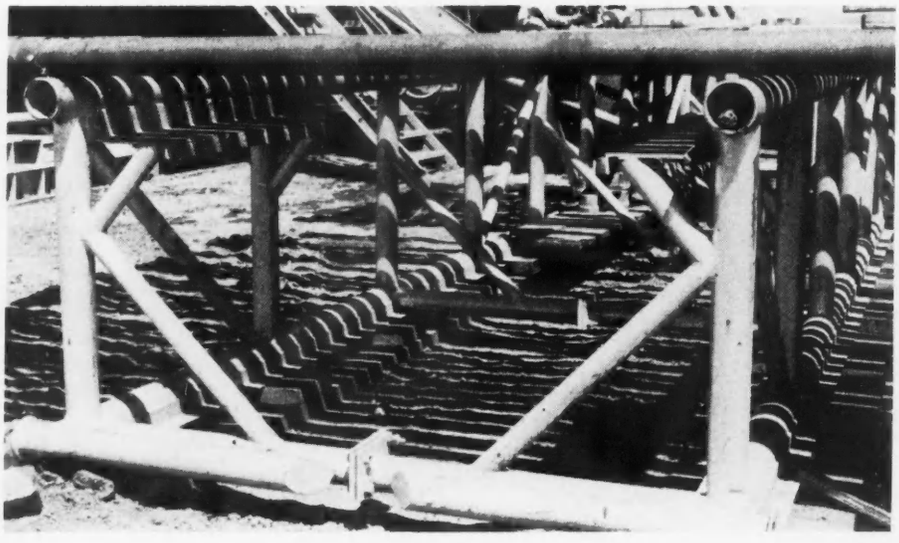
1032 So. Central Ave., Chicago 44, Illinois

generating plant of rotary drilling rigs, there is still the necessity of incorporating many manual controls which act as safeguards in the event the automatic equipment fails to function properly. On extra heavy-duty steam rigs utilizing four or five 150 horsepower, 300 pounds per square inch working pressure boilers, the fireman's task of producing adequate quantities of steam during heavy demands can be considerably facilitated by grouping the manual controls at one manifold.

Illustrated is part of the manual feed water controls for a four-boiler setup. The feed water pumps have been set between the control manifold and the boilers, in full view of the fireman standing at the manifold. While boiler feed water controls have been grouped such as illustrated for some time, the outstanding feature of the installation shown is the feed water pump controls which are also grouped with the manual feed water control valves. This was made possible by a universal joint, a ¾-inch steel rod, a salvaged valve wheel and a supporting section of 1-inch pipe.

The universal joint was welded to the stem of the steam control valve on the feed water pumps. A ¾-inch steel rod extending to the control manifold was added. This rod is supported in position by a short section of 1-inch pipe which has been tack-welded to the lower side of the horizontal feed water control manifold. Grouping the controls in this manner makes it possible for the fireman to cope with a variety of conditions requiring manual operation.

HOW TO—Construct Demountable Pipe Rack



An unusually efficient type of drill pipe rack designed by one company has the unique feature of having incorporated in its construction a means of breaking it down into two sections to simplify handling and transportation problems. The rack, illustrated in the accompanying photograph, is braced in such a manner that lateral members are not required in the upper part of the unit. Angle braces were welded between the verticals and the base members in such a manner that the structure cannot bend or twist under the heavy loads placed upon the rack. Laterals are placed across the bottom, however, and these are the members which are cut in half and fitted with square flange plates, each of these flanges being bolted together with four bolts.

Another desirable feature incorporated in the rack is a pair of 12-inch wide shelves welded to the inside top part of the rack on which may be rested skids used in loading and unloading of pipe. Visible near the top of the rack, these shelves are amply braced and are sufficiently long that skids may be placed wherever desired to obtain the desired slope between rack and the top of the truck load.

In order to better distribute the load on planking on which the rack is placed, heavy angle iron is welded to both sides of each longtitudinal base member.

Announcing

the REED *Jet* BIT

THE ORIGINAL JET TYPE BIT
WITH THE REPLACEABLE SLUSH NOZZLE

PROVED AFTER 12 MONTHS TESTING

INCREASED RATE OF PENETRATION FOR LOWER DRILLING COSTS

After thorough testing in the field, with the aid of major companies, we offer you the Reed Jet Bit with the assurance that it will greatly increase rate of penetration with greater efficiency, and lower your drilling costs.

The drilling fluid is discharged at a high velocity ahead of the bit blades. This construction protects the blades from erosion and makes full use of the high velocity jet for disintegration of the cuttings.

The exclusive Reed replaceable slush nozzle shown at the left permits the use of tungsten carbide nozzles for added resistance to abrasion and for interchangeability of jet sizes at different depths.

Contact a Reed representative for full details, or write the company direct.

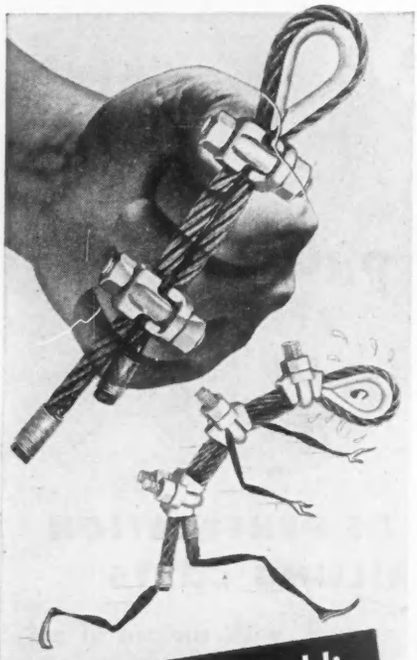
BE SAFE WITH REED

Reed **ROLLER BIT COMPANY**

HOUSTON 1, TEXAS

THE REED STAMP OF QUALITY

BANISH YOUR WIRE ROPE PROBLEMS



...With The Laughlin "FIST-GRIP" SAFETY CLIP

Won't Crimp or Crush . . . rope lasts longer.

Simple, easy to put on . . . saves time, manpower.

100% Foolproof . . . can't go on backwards.

Super Grip . . . two clips do the work of three U-Bolts.

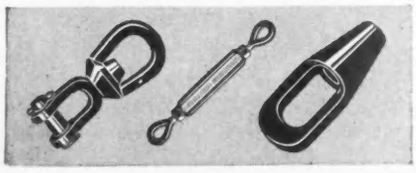
Extra Strength and Safety . . . clip and bolts drop-forged.

Distributed through mine, mill and oil supply houses. Write for Catalog 140 . . . up-to-the-minute data on industrial fittings.

THE THOMAS LAUGHLIN COMPANY
Dept. 23, Portland 6, Maine

LAUGHLIN

THE MOST COMPLETE LINE OF DROP-FORGED WIRE ROPE AND CHAIN FITTINGS

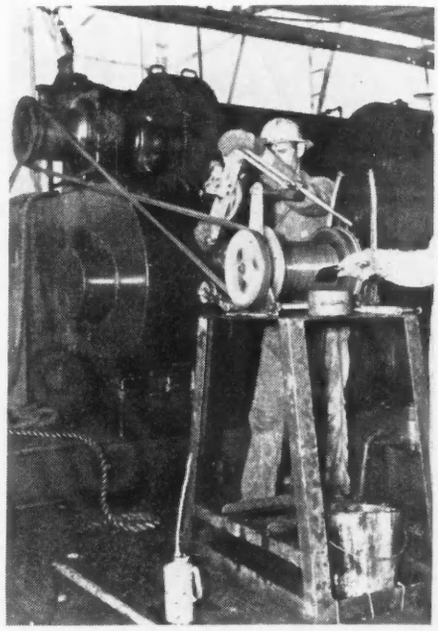


DRILLING HINTS

HOW TO—Drive Wire Line Measuring Device

While not efficient in the true sense of the word, here is one convenient method of driving the wire line measuring reel without the normal amount of clutches, low-horsepower engine, etc., usually required in making depth measurements. Primary use of this device lies in checking drill pipe measurements when several hundred feet of hole are made per tour. When pipe is added to the string rapidly, it is quite possible to omit adding the length of one joint. A simple check with the wire line will indicate accuracy of drill pipe measurements. The line is attached to a sinker bar which is lowered inside the drill pipe.

The wire line drum, measuring reel, and drum brakes have been mounted on a metal platform made from angle iron and steel plate. Four bolt holes in the top metal plate are used to bolt the unit to the platform, which in turn is bolted to the engine platform about eight feet to the rear of the breakout cathead.



The outboard flange on the breakout cathead contains a V-notch which has been turned down on a lathe. The V-notch is of such a size to receive a standard V-belt. In withdrawing the wire line from the drill pipe, the V-belt is twisted as shown. When lowering the wire line, the V-belt is threaded on the two sheaves in one loop to provide control over lowering speeds by means of the drawworks.

Two angle iron members are welded to two supporting legs near the base of the platform to provide a means of cradling, the wire line drum during rig moves. The unit is bolted to the angle iron members, thereby giving ample protection for transporting.

HOW TO—Protect Exposed Derrick Leg Studs

When the drilling rig is moved off the well, many companies find it prudent to delay cutting off anchor studs until it is certain that the well will not have to be re-drilled or otherwise worked on. To protect the exposed threaded ends of the studs, some companies install nuts or a protective metal cap on the threads which may or may not protect the threads from corrosion.

One operator, however, finds it much easier and quicker to merely wrap the studs with a strip of burlap, tying it securely with a number of turns of stranded soft rope. Soaked with lubricating oil, this wrapping will prevent corrosion and at the same time will provide moderate protection from all but the heaviest blows that might occur during installation of flow or pumping equipment. Principal advantage of this temporary wrapping is the availability of the necessary materials at the time the studs are first exposed.

HERE ARE THE EXTRAS
you get when you buy an engine from
STEWART & STEVENSON SERVICES

Guaranteed Performance
Service Certificates
Centralized Responsibility
Stewart & Stevenson One-Trip Service
Factory-Trained Engine Experts
Flat Rate Zone Trip Charges

These STEWART & STEVENSON
SERVICE CERTIFICATES
give you extra protection when you buy an engine from us

The Stewart & Stevenson Service Certificate is another of the many extras you get when you purchase an engine from Stewart & Stevenson Services.

FIRST: The certificate entitles you to initial installation, inspection service as well as instructions on the proper operation, care and maintenance of your engine.

SECOND: It entitles you to a 30-day inspection and tune-up by a Stewart & Stevenson engineer.

THIRD: The Stewart & Stevenson guarantee of duty supplements the manufacturer's warranty.

Add Stewart & Stevenson Service Certificates to all the other extras you get and you find they add up to Service Satisfaction for the engine owner. That's why Stewart & Stevenson has become one of the largest engine distributors in the world.

STEWART & STEVENSON SERVICES, Inc.

HOUSTON 4516 Harrisburg Blvd. Phone W. 6-9691
DALLAS 4801 Lemon Ave. Phone L. 6-6649
CORPUS CHRISTI 643 N. Port Ave. Phone 8252
McALLEN 19 East Highway Phone 1760
WICHITA FALLS P. O. Box 1415 Phone 2-3319
GREGGTON P. O. Box 546 Phone 2007
LUBBOCK 1624 4th Ave.

DEALERS:
Sabine Propeller & Marine Service, Port Arthur, Texas
Balch Truck & Implement Company, San Angelo, Texas
Phillips-Torgerson Company, San Antonio, Texas
Standard Engine Company, Longview, Texas

SALES REPRESENTATIVES
BEAUMONT Phone 2-9619
LONGVIEW Phone 3292-R
LIVINGSTON Phone 429-G
LAREDO Phone 1513

DISTRIBUTORS OF: General Motors Diesel Engines 30 to 800 horsepower • Chicago Pneumatic Gas and Diesel Engines 300 to 1650 horsepower • Continental Red Seal Gas and Diesel Engines 10 to 200 horsepower • Adel Hydraulic Controls Gardner-Denver Pumps

FABRICATORS OF: Electric Power Units • Electrical Control Equipment • Truck Bodies Portable Pumping Units, Etc.

GM GENERAL MOTORS DIESEL POWER
CONTINENTAL MOTORS AMERICA'S STANDARD

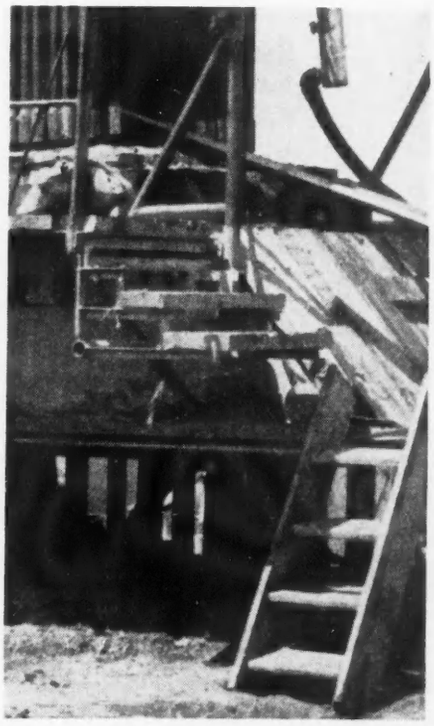
PARTS • SERVICE
ANYTIME • ANYWHERE

THE NATION'S LARGEST DISTRIBUTORS OF GM DIESEL ENGINES

HOW TO—Provide Easily-Installed Stairway for Portable Rig

Rigging up and tearning down portable rigs has been considerably facilitated by incorporating the heavy equipment on the truck or trailer bed. Equipment which is not already in position can be so placed by meachanical means afforded by the truck's power. For this reason, the component parts on the portable rig are extremely compact, having to conform to highway restrictions of all states.

To provide adequate space on which to work around the derrick floor, additional platforms must be added. These added walk-arounds in many cases make it possible to incorporate a simple, easily-installed stairway for crewmen to get on and off the derrick floor safely. Such a simplified setup is shown on one portable rig. For convenience in setting up, only three steps were incorporated in the additional platform structure. The remainder of the steps was built from timber at the location.



The three steps are supported by steel angle iron and pipe. Two horizontal members are made from 3-inch pipe, to which is welded the framework of angle iron as shown. Both supporting pipe members telescope into matching sections which have been permanently welded into the heavy I-beam section supporting the drill pipe. Two such members counteract the overturn moment resulting when force is applied on the wooden treads of the steps. These treads are wooden planks which fit into the steel framework. Anti-slip material can be tacked to the wooden treads for added safety. Steps thus constructed can be slipped in place quickly, and can be transported separately.

BIG FOUR TOPS FOR SLIM HOLE RIGS

- EASIER HANDLING
- STABILIZES KELLY JOINT
- NO MUD IN BOWL
- EASY SWIVELING
- LOWER COST

It handles easier **because the swivel bail has been eliminated. The swivel hangs straight and true in the derrick as it's handled by elevators. Its sides aren't hammered by the elevators to place unbalanced load on the kelly joint.**

The kelly joint tends to stabilize **because the body rotates while the stem is stationary. A gyroscopic action is thus produced, tending to keep the kelly straight whatever the pipe weight on the bit.**

The unique wash pipe design **prevents mud from entering bowl. Chevron packing prevents excessive tightening.**

It swivels easily **because the heavy duty roller bearing operates in an oil bath while vertical bearings keep stem in perfect alignment.**

It costs less **because it has fewer working parts and is simple in design. Available in 3½" and 4½" sizes, for drilling to 4000 feet with usual drill pipe.**

MANUFACTURERS OF BIG FOUR (BRAUER) PRODUCTS

• Portable Drilling Rig • Standpipe Gooseneck • Drill Pipe Float • Long Sweep Ell • Improved Release Valve • Hydraulic Wall Hook • Slim Hole Swivel

BIG FOUR MACHINE AND SUPPLY COMPANY

CLAY CITY, ILLINOIS

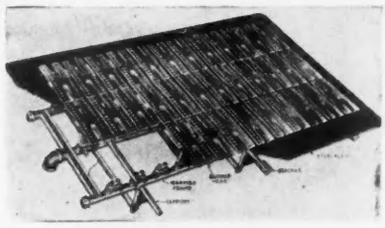
C & W Machine Works Company is authorized distributor for the entire state of Kansas for all BIG FOUR MACHINE & SUPPLY COMPANY (Brauer) Products. All C & W manufactured items and Big Four products are available here for distribution through supply stores.

HENRY H. PARIS DISTRIBUTOR Inc.

Manufacturer's Agent - Oil Well and Refinery Supplies

P. O. BOX 932 — 1125 ROTHWELL ST.

HOUSTON, TEXAS



VOLCANO SUPERIOR GAS BURNERS

These burners derive their higher efficiency and longer life from such features as: All-steel construction; Burner heads with double barrel shank and double mixer are equivalent to two ordinary burner heads; Slight H-shape of head assures more perfect combustion by proper circulation of secondary air; series of heads on triple manifold covers approximately entire firebox area. For superior efficiency, specify Volcano Superior Gas Burners.

Agent and Distributor for the following Nationally known Manufacturers

W. C. NORRIS MANUFACTURER, INC.
Tulsa, Oklahoma
Quality Pumping Equipment, Swage Nipples, Bull Plugs, Welding Fittings, etc.

WHEELING MACHINE PRODUCTS CO.
Wheeling, West Virginia
XL Steel Pipe Couplings for OIL COUNTRY TUBULAR PRODUCTS. Gas-Water-Steam.

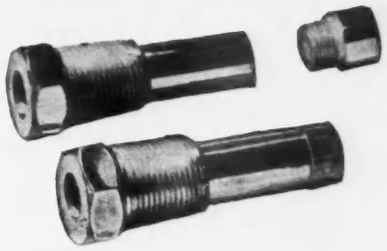
THE OHIO INJECTOR COMPANY
Wadsworth, Ohio
OIC VALVES, Bronze, Iron and Steel, for all purposes. "Oh! I See Lower Costs with OIC."

HARRISBURG STEEL CORPORATION
Harrisburg, Pennsylvania
Forged Steel Flanges and Seamless Casing Couplings.

VOLCANO BURNER COMPANY
Houston, Texas
Volcano Superior and Gulf States All Steel Gas Burners for OIL COUNTRY BOILERS.

OIL STATES EQUIPMENT COMPANY
Houston, Texas
OSECO Silvertop Fusible Plugs with renewable inserts for all types OIL COUNTRY BOILERS.

DRESSER MANUFACTURING DIV.
Bradford, Pa.
Seamless Welding Fittings.



Oseco High Pressure Fusible Plug

Unique design permits replacement of inserts instead of the entire plug. OSECO "Silver Top" plugs are made in all standard sizes of best quality bronze, under A.S.M.E. specifications, for 300 and 350 lb. oil field boilers. They can also be furnished in Monel or Stainless Steel.

Select High Alloy Steel LONGHORN TUBE JOINTS

Features:

1. Eliminate wear and tear on tubing threads
2. Save time on round trips
3. Prevent crushed tubing by tong action
4. Have full opening for bottom hole tools
5. Are 100% interchangeable

LONGHORN TUBE JOINTS save money in well completion and reworking operations because they permit varied use of tubing where expensive strings of drill pipe might otherwise be required.

Available in standard sizes. Others furnished to customer requirements. Special, all-metal skid mounted, protective carrying case can be furnished.

SOLD THROUGH YOUR SUPPLY STORE
Write for literature and price lists.

Longhorn MACHINE WORKS
6823 Navigation
Houston, Texas
Dallas Branch: 3901 Southwestern

LOG WHILE YOU DRILL...

Geolograph logs foot by foot . . . 24-hours a day . . . shows formation changes, drilling depth and down time - - at all times!

Geolograph saves in many ways for both large and small operator! Write for details now!

"TIME WILL TELL"

THE GEOLOGRAPH CO. INC.

P. O. Box 1291 — Oklahoma City 1, Okla.

Sterling
PUMPS • HOISTS • LIGHT PLANTS
DEPENDABLE
RUGGED
SIMPLE
•
SAVE
MONEY
SAVE
TIME

STERLING QUALITY
See pages 3984 and 3985, Composite Catalog, and page 761, Refinery Catalog.
STERLING
MACHINERY CORPORATION
405-13 SOUTHWEST BLVD. KANSAS CITY 10, MO.

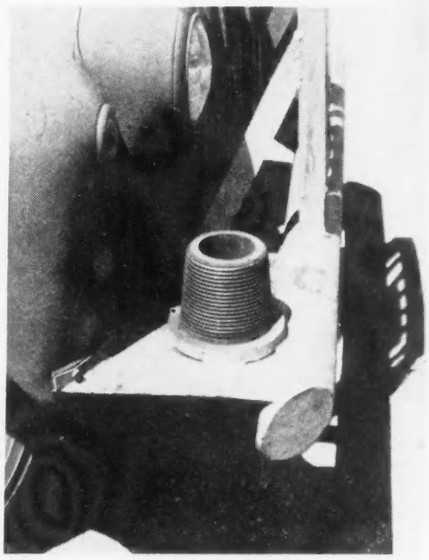
MASS PRODUCTION?
NO!
NOT IN OIL EXPLORATION!
CAREFULLY INDIVIDUALIZED
GEOPHYSICAL WORK
ADAPTED TO THE
FACTS IN EACH PARTICULAR
CASE, BOTH IN THE FIELD
AND IN THE OFFICE.
KLAUS
EXPLORATION CO.
LUBBOCK, TEXAS

QUICK DELIVERIES ON
STEAM CONDENSERS
and
FEED WATER HEATERS
We deliver small condensers and feed water heaters built to your specifications in days instead of weeks or months.
Call us also for expert maintenance of your condensers and feed water heaters — QUICK SERVICE.
25 Years Successful Experience
GULF ENGINEERING CO., INC.
"Service, Not Promises"
1682 INGEBORG ST. HOUSTON, TEXAS
916 S. PETERS STREET NEW ORLEANS, LA.

HOW TO—Install Tool-Carrying Bumper Bracket

In order to facilitate and speed the handling of subs and similar short heavy tools, one company finds it convenient and economical to equip their field pick-up trucks with a special reinforced bumper on which can be mounted drill pipe sub pins. As shown in the photograph, the bumper is made of a length of 3-inch pipe, the ends of which are strengthened by welding to them triangular gussets of steel plate, the latter also being bolted to the front lower edges of the fenders.

A well braced grill guard also is welded to the central portion of the pipe bumper. Carrying this type of equipment on such a bumper rack not only leaves more room in the truck bed for other tools or materials, but assures the safe transporting of threaded tools without danger of having threads injured. Being mounted close to the ground, the rack eliminates much of the lifting normally required to load such tools on the higher truck bed.

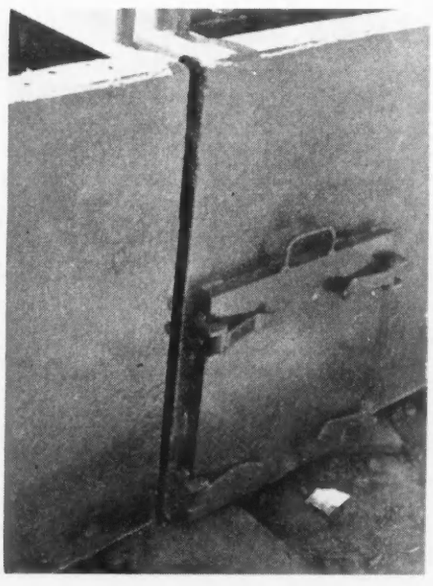


HOW TO—Make Quick-Acting Tank Cleanout Gate

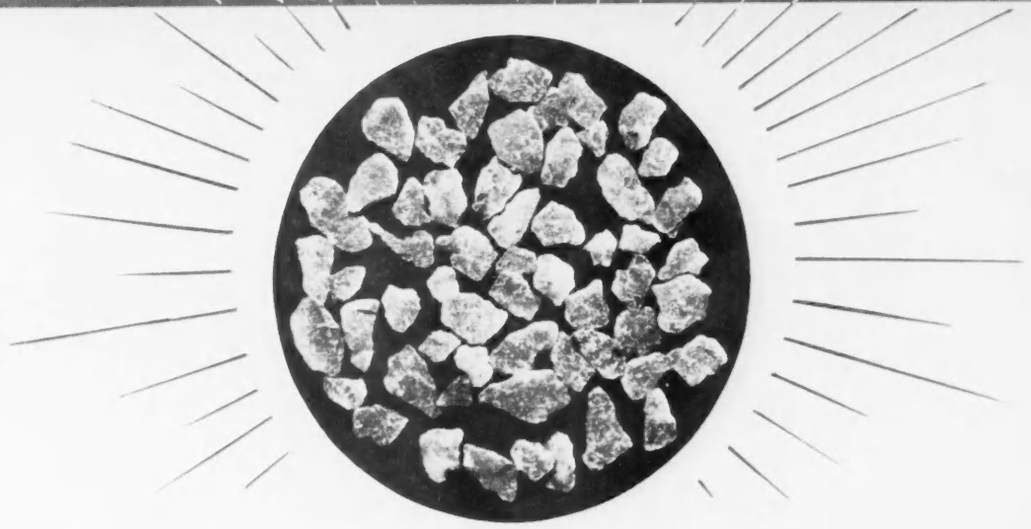
The clean-out opening on the side of a mud tank commonly consists of a short nipple or coupling of large diameter pipe welded into the side, and which is closed off by means of a gate or shop-made screw thread plug. An improvement over this type gate designed by the drilling department of one company requires no pipe fittings or valves, yet it is quickly operated and permits a larger opening to speed emptying of the tank.

Around the large square opening in the tank side is welded a frame of ¾-inch steel plate. Matching this plate in size is a similar piece of ¼-inch material, the latter serving as the gate. Four lugs of special design hold the cover plate tightly against the base plate.

The fixed portion of each lug is welded to the side of the base plate. The locking device, which rotates around a vertical pin, consists of a short piece of round bar stock, the vertical hole in which is drilled off center to form an eccentric. Pressing the latch handle against the plate rotates the eccentric against the door. Although considerable pressure is exerted against the gate plate, the latter is easily and quickly released merely by flipping back the latch handles. A convenient handle welded to the upper edge of the gate facilitates removal and positioning the plate.



Permeability Trends from Reverse Circulation Bit Cuttings



Typical sample of reverse circulation bit cuttings from limestone or dolomite (actual size, thickness 1 to 2 mm).

By N. P. WHALEY
Whaley Engineering Company
Tulsa

USE OF drill cuttings obtained through reverse circulation as a means for determining formation characteristics is discussed and the value of such "chip coring" emphasized. Test data obtained from relatively small fragments of the formation often may be made to augment or even to confute the apparent evidence of other down-the-hole surveys, and thus to enable holes to be saved or operations suspended as appears most expedient.

DURING the past several years porosity values measured on drill cuttings, taken with reverse circulation, have been useful in determining the porosity of formations when coring of such formations was not economical or practical. Westbrook and Redman[1] describe a method of determining the porosity of consolidated formations from the drill returns. This consists essentially of determining the grain volume of a large number of weighed, dried bit cuttings by water displacement, removing surplus surface liquid from the saturated cuttings by a capillary diaphragm, and determining bulk volume of the saturated cuttings by water displacement.

These authors point out the usefulness of porosity data in estimating the permeability of a formation, provided that a correlation of these two properties has been obtained from the analysis of cores from the particular formation and also its usefulness in interpreting electric logs.[2] They also call attention to the importance of having a method for determining the porosity of formations by some means other than coring in view of the many cases, even in wildcat wells, in which it is neither economical nor practical to core all formations.

The economic aspects of exploratory operations often make it very desirable to the petroleum engineer to secure various formational data in addition to porosity from the drill cuttings and this need has resulted in laboratory research being conducted to find means of developing progressively more formational data from smaller and smaller samples. "Chip coring" with cable tools and sand pump, instead of a bailer, is being used to a great extent in secondary recovery operations and very satisfactory results are shown in laboratory tests of these small "chips." May[3] describes techniques for testing such drill cuttings or chips from the Bradford sand in Pennsylvania. In addition to porosity, May measures permeability of cuttings of sufficient size (0.5 to 1.0 cm, in diameter and 0.7 to 1.5 cm. in length), saturation, and in some cases, conducts a miniature flood test. He concludes that in the Bradford field, chip coring is being used widely as an aid in reservoir engineering. Laboratory and field data are presented which indicate that oil saturation values from drill cuttings will represent formation condi-

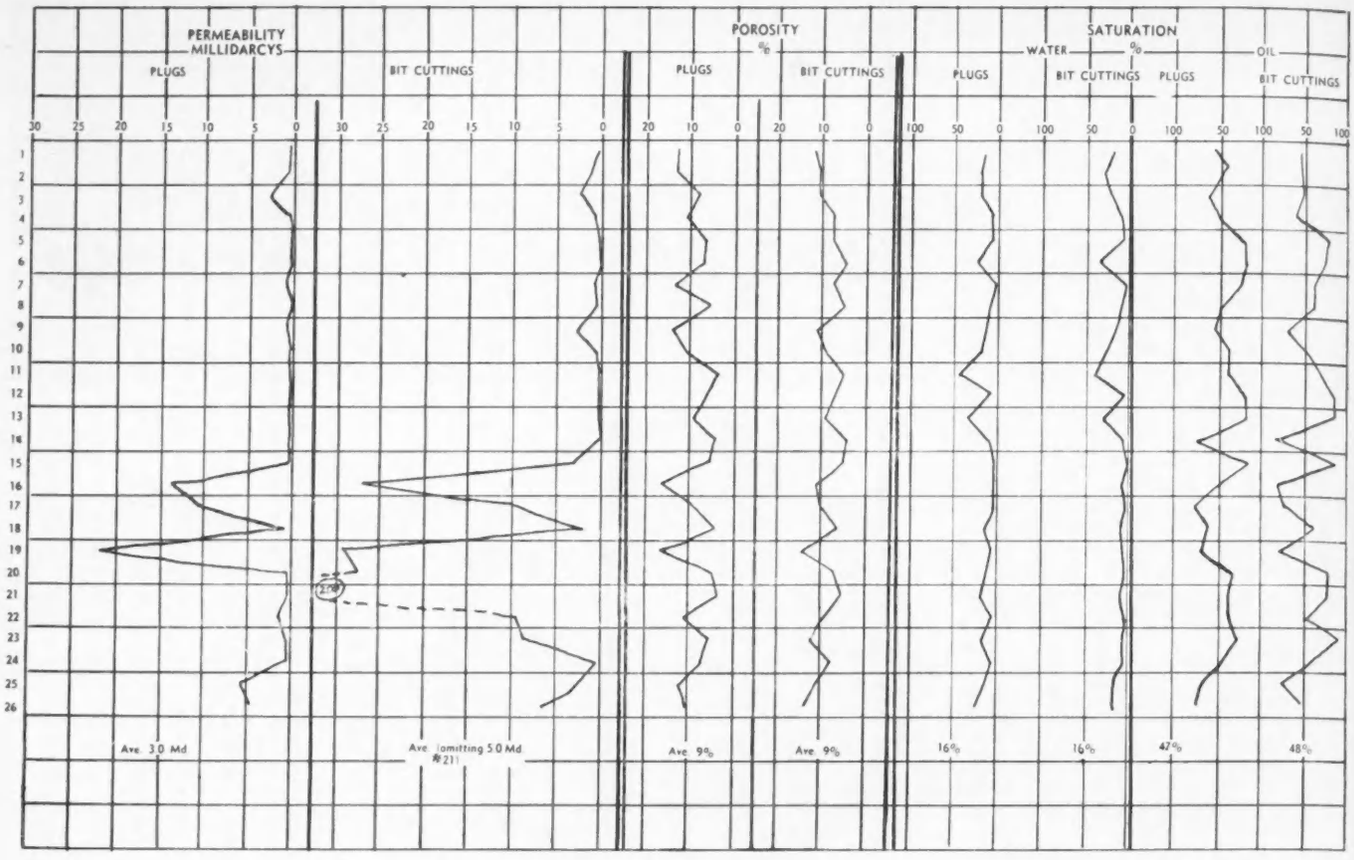


FIGURE 1. Comparing results of core and bit cutting analysis. Here is shown the similarity between the trends of permeability curves from permeability tests made on cores and bit cuttings. The close conformity of other data may also be observed. The graph illustrates the feasibility of using permeability tests on bit cuttings to indicate permeability trends in limestone or dolomite formations.

tions even though the formation pressure may vary widely, and also that drill chip samples retain the sand characteristics as found in place in the formation.

While these tests were conducted on samples of from 0.5 to 1.0 cm. in diameter and 0.7 to 1.5 cm. in length, tests on reverse circulation bit cuttings must be made on samples ranging from .4 to .5 cm. wide by .5 to 1.5 cm. long and only .1 to .2 cm. thick. As a consequence of the small size of the reverse circulation bit cuttings, no method has been reported of successfully determining permeability information from these small chips. The difficulties of determining permeability data on these small bit cuttings were enhanced by the fact that in most cases the formations on which the permeability data were desired were highly consolidated with a low range of permeability ranging from less than 0.5 millidarcy to 10 or 20 millidarcys at the most.

Significant Data

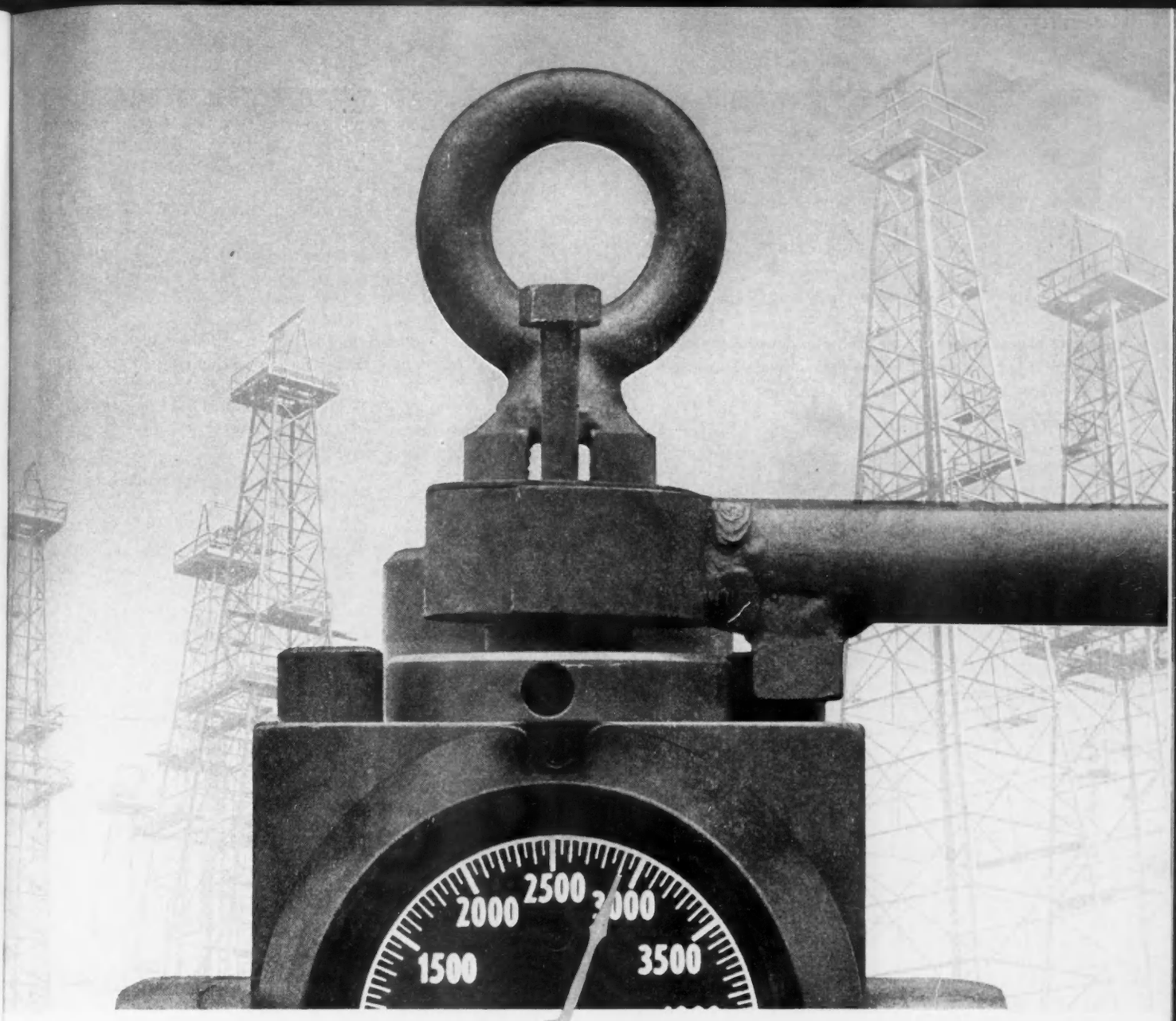
Yet the need is great for permeability determinations of the tight formations from bit cutting analysis because of its valuable aid in projecting well behavior in many reservoirs. It should be noted that porosity and any other information that it has been possible to secure from bit cuttings has proved to be significant and of considerable aid to the petroleum engineer in his studies of reservoir behavior.

During the past several years the writer has made numerous tests on literally thousands of samples of reverse circulation bit cuttings and has made a serious study of the application of the data secured to the practical problems of the petroleum engineer in evaluating limestone and dolomitic reservoirs. The results of some of the tests made on such bit cuttings led to the conclusion that it is possible to predict more accurately the performance of a particular reservoir after studying the data secured from tests on such cuttings than from data secured from cores. At any rate, the physical test data from bit cuttings should be at least as fairly representative of the formation as the same data from cores.

It is well known that the performance of many limestone and dolomitic producing formations does not check well with that indicated from core analysis alone. In many cases the wells produce oil at a much greater rate than permeability data from cores would indicate. Ever since oil has been produced from limestones, operators have been surprised at the impressive amounts of oil produced from seemingly impervious formations. One explanation advanced to account for the production from such tight formations was that most of the oil came from joint planes and crevices and that only a very small proportion of the total production came from solution cavities and small "pores" or low permeability zones; however, this theory is very ably answered in a recent paper by Gibson[4], who cites production data from an area in Southwestern Iran in which preliminary observations indicated that production could be obtained only from wells penetrating open fissures in the limestone formations of low permeability, whereas later production data showed the supply of oil furnished the well by the fissure was being replenished from the low permeability limestone from which the rate of flow was limited.

Permeability of Chips

The lack of agreement, in many cases, between core data and well productivity prompted the writer to investigate the possibility that permeability of bit cuttings might furnish a better index than the same information from a test plug



It tells all...*HERE*

Well Fluid Level
Pump Condition
Pump Loading
Pump Speed

If you are *Free Pumping*, your pressure gauge can tell you the facts you need to know to control the performance of your well. It reflects the constantly changing bottom hole conditions and serves as a safeguard against costly emergency breakdowns.

The very nature of Kobe *Free Pumping* permits you to act promptly in meeting changes in bottom hole conditions. If, for instance, your pressure gauge indicates the desirability of examining or replacing the pump, it can be *surfaced* by the turn of a valve. You don't have to wait for service equipment or pulling crews and avoid costly delays due to weather or location obstacles. Pulling expense is thus eliminated from your cost of lifting oil.

These are some of the reasons you can get better production planning with Kobe *Free Pumping* and reduce your pumping operating costs as much as 15 to 40%. For complete information on the economies of *Free Pumping* and its application to your production problems, call your local Kobe representative.

Free Pump
KOBE
ONE OF THE DRESSER INDUSTRIES

KOBE, INC. *General Offices:* Huntington Park, Calif. *Division and District Offices:* Avenal, Bakersfield and Huntington Park, Calif.; Rangely, Colo.; Ardmore, Oklahoma City and Tulsa, Okla.; Brownfield, Corpus Christi, Houston, Longview, Odessa and Wichita Falls, Texas; Brookhaven, Mississippi; Hobbs, New Mexico; New York City.

THESE ARE THE DAYS OF FREE PUMPING

drilled from a core sample. This hypothesis was based on the assumption that permeability determinations from a number of "chips" from each foot of sample would yield a truer average permeability value than would the same test made on one or two plugs drilled from a core.

Since many chips from each representative sample would have to be tested, it was necessary to develop a method of determining the permeability of the chips which was both rapid and accurate. This proved to be a difficult but not insurmountable task.

A group of cores was selected for this investigation from a West Texas well. These cores had the appearance of low porosity and permeability. A portion of the log of this well is shown on Figure 1. Test plugs were drilled from each foot of core sample and then chips similar in size to those recovered by reverse circulation were prepared by flaking from parts of the core adjacent to the test plugs. Saturation samples were also prepared. The ordinary core analysis was made on the test plugs and in addition porosity and permeability tests were made on the chips.

First Results

The first series of test results, when tabulated, was not particularly encouraging, in that an appreciable proportion of the bit cutting permeability values did not correlate closely with those of the core tests. However, in the majority of cases close comparisons were obtained and it was observed from these tests that horizontal and vertical permeability values determined on the small chips were almost identical.

After considerable study of the test plugs and chips it was determined that the biggest factor in the differences between the permeabilities of the test plug and chips was a matter of technique in the preliminary examination of the chips and the selection of representative samples. The varying amounts of anhydrite and its distribution were found to be the greatest single factor in the difference of the permeability as well as in the porosity results. In hundreds of tests it was observed that the differences in permeability from chip to chip in a single sample were of the same order as permeability differences of two or more test plugs drilled close together. After mastering the technique involved in bit-cutting analysis, the results of the tests on the test plugs and chips began to show closer correlation. Although not quite exact, it became evident that the trend pattern rather than exact or close correlation would be the most usable information. This method was followed and a graphic comparison made of the core and bit cutting test results. The similarity of these trend patterns is apparently very good and presents a challenging picture for study. The permeability data must be plotted against porosity and saturation curves to give the best picture.

To illustrate the manner in which the permeability trend curve is plotted against porosity and saturation, reference is made to the accompanying graph. The bit cutting permeability curve at point No. 21 shows an unusually high value and to get a true picture this portion of the curve is shown by dotted lines. Many chips were tested to obtain the average value shown for this sample and the individual permeability values ranged from 180 to 212 millidarcys while the corresponding plug showed less than 0.5 millidarcy permeability. In interpreting the results from bit cutting analysis alone the section from points No. 16 to No. 24 would be considered as a unit and would be interpreted as a zone of much higher average permeability than the zones immediately above and below. If a close study is made of this graph it will be noticed that for every indication of trend in the curves of the core analysis results there is the same identical trend in the curves of the bit cutting analysis results with the exception that minor variations seem to be more definite in the tests on the bit cuttings.

The writer does not claim absolute exactness on the correlation between the results of permeability tests made on bit cuttings and similar tests of corresponding core samples, but does maintain that the permeability trend of tests on bit cuttings will furnish the petroleum engineer another valuable aid in evaluating the difficult production problems inherent in the oil-producing horizons of the Permian Basin and other areas of similar geologic history.

Another Application

For example, permeability profiles based on bit cutting analysis should prove very useful in determining productive zones more accurately and in various well completion methods especially those involving selective acidizing. This latter method of well completion was ably summarized in a recent paper by Moore and Kollar.[5] These authors describe procedures of selective acidizing through which important reserves have been made available that otherwise would not have been recovered and conclude that this has been brought about largely by determination and analysis of reservoir conditions in which permeability surveys have played an important part.

Another possible application of bit cutting permeability profiles will be in estimating irreducible water saturation values of formations by utilizing the known relationship between permeability and irreducible water content. For any particular area it would be necessary to analyze bit cuttings from a few wells in which oil base mud was used to establish the correlation between permeability and water content. The correlation subsequently would be used to estimate irreducible water saturation for any other wells in the area in which non-oil base mud might be used in recovering the bit cuttings.

The foregoing considerations indicate that bit cutting analysis will assume progressively increasing importance in field operations as the background of test data accumulates.

About the Author

N. P. WHALEY was born in Afton, Okla., and after serving in World War I entered Kansas State Teachers College. He later joined United Iron Works as mechanical engineer and worked in Joplin, Mo., and Independence, Kansas. In 1926 he took charge of field operations for Sands Petroleum Corporation. He has specialized in secondary recovery work for 15 years and has had considerable experience in this field in the Southwest. Last year he resigned as general manager of Sands Petroleum to devote full time as petroleum production consultant with headquarters at Tulsa.

REFERENCES

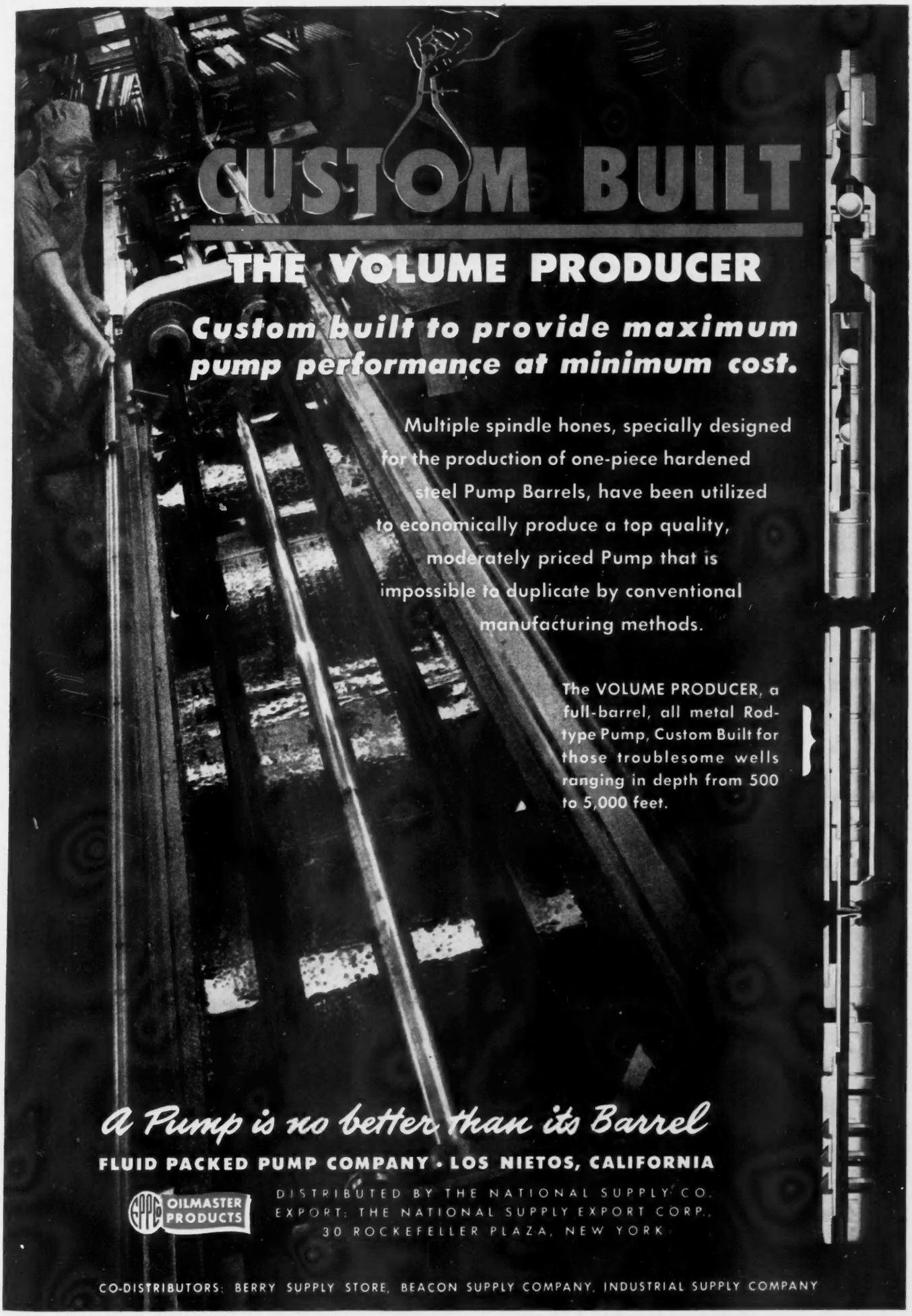
[1] M. A. Westbrook and J. F. Redmond, "A New Technique for Determining Porosity of Drill Cuttings," AIME Petr. Dev. and Tech., 1946, pp. 219-222.

[2] G. E. Archer, "The Electrical-Resistivity Log as an Aid in Determining Some Reservoir Characteristics," Trans. AIME 1942, pp. 146-154.

[3] Donald T. May, "Chip Coring Techniques," PRODUCERS MONTHLY, Aug. 1948, pp. 30-49.

[4] H. S. Gibson, "Oil Production from Fields of Southwestern Iran," WORLD OIL, May 1948, pp. 62-66.

[5] J. M. Moore and R. E. Kollar, "Selective Acidizing with the Electric Pilot," PETROLEUM ENGINEER, Sept. 1948, pp. 150-155.


CUSTOM BUILT
THE VOLUME PRODUCER
Custom built to provide maximum pump performance at minimum cost.
Multiple spindle hones, specially designed for the production of one-piece hardened steel Pump Barrels, have been utilized to economically produce a top quality, moderately priced Pump that is impossible to duplicate by conventional manufacturing methods.
The VOLUME PRODUCER, a full-barrel, all metal Rod-type Pump, Custom Built for those troublesome wells ranging in depth from 500 to 5,000 feet.
A Pump is no better than its Barrel
FLUID PACKED PUMP COMPANY • LOS NIETOS, CALIFORNIA
OILMASTER PRODUCTS
DISTRIBUTED BY THE NATIONAL SUPPLY CO.
EXPORT: THE NATIONAL SUPPLY EXPORT CORP.,
30 ROCKEFELLER PLAZA, NEW YORK
CO-DISTRIBUTORS: BERRY SUPPLY STORE, BEACON SUPPLY COMPANY, INDUSTRIAL SUPPLY COMPANY

Successful Gas Repressuring in North Texas

By ROLAND GOULDY and GORDON R. STINE

Petroleum Engineer
Bridwell Oil Company
Wichita Falls

Petroleum Engineer
Cable & Stine
Wichita Falls

THE first gas repressuring project to be undertaken in North Texas was started in the Petrolia Field, Clay County, by the Western Oil Corporation and Albert Crenshaw in February, 1926. Gas purchased from the Lone Star Gas Company was injected into three shallow sands, increasing the daily oil production from 100 to 450 barrels. This project included about 300 wells. A short time before the Petrolia project started, Dunn and Lewis had commenced injecting air into the producing sand of their Zink lease south of Iowa Park in Wichita County.

THIS SURVEY of projects in which gas has been successfully utilized to obtain highly satisfactory increases in production presents a background of data which should be useful in determining probable effect of such practice on other leases, not now so produced. The production charts adduced reflect the effect of gas use and provide basis for evaluating the possibilities of the system.

Following the success of the Petrolia project, several leases in the area were subjected to gas injection with varying degrees of success, but it was not until 1933 that repressuring came into widespread use in North Texas.

Available records[1,2] show that gas has been injected on 646 leases with 5029 producing wells and 852 input wells in North Texas (Railroad Commission District No. 9). Some of these projects are now abandoned; however, there are many in operation on which no records are available, and it is probable that total current production from repres-

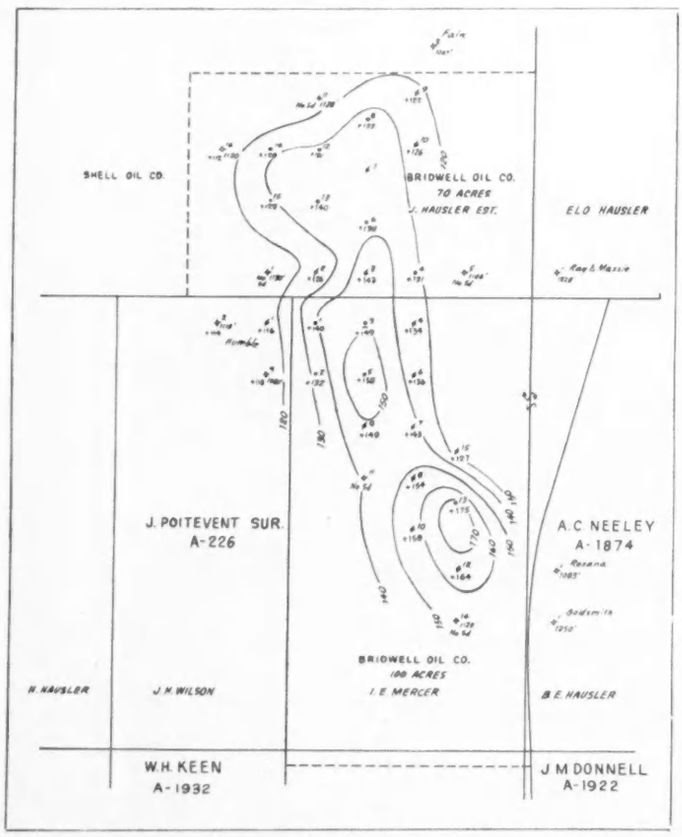


FIGURE 1. Mercer field, Young County, Texas, contoured top of sand.

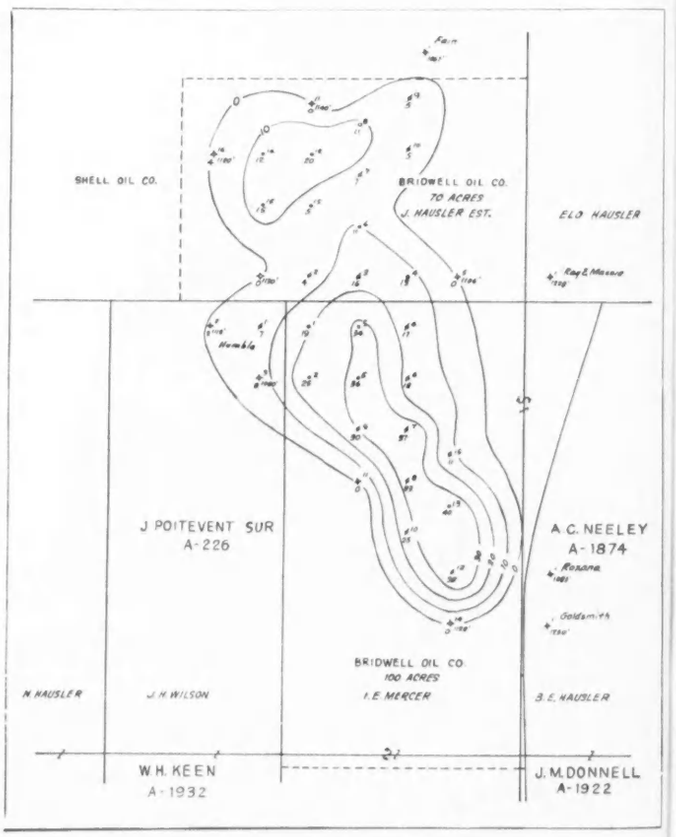


FIGURE 2. Mercer field, Young County, Texas, sand thickness map.

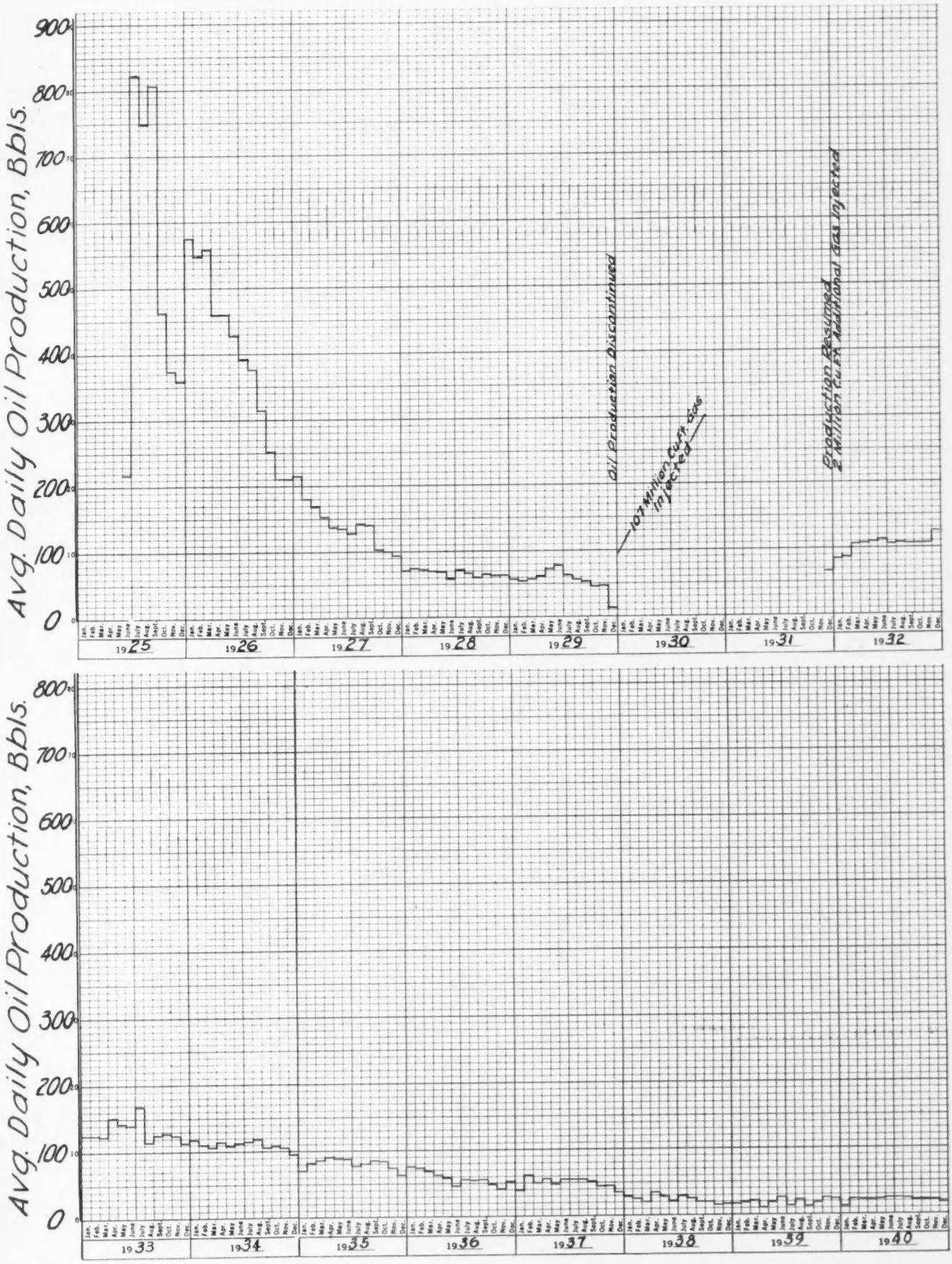


FIGURE 3. Mercer field, Young County, Texas.

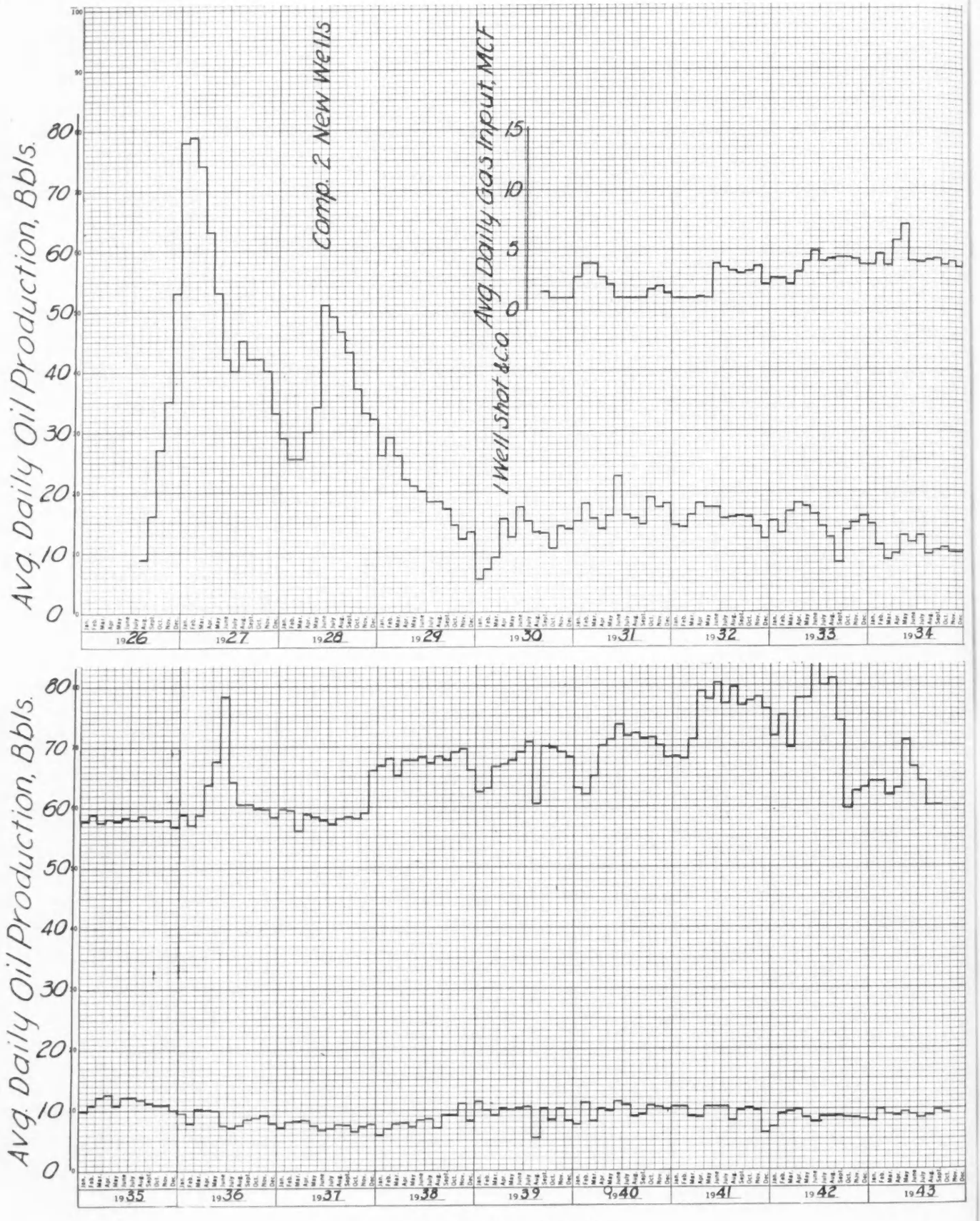


FIGURE 4. Lease "A," Young County, Texas.

sured leases in North Texas exceeds 35,000 barrels per day.

Most of the production affected by repressuring has been from Cisco sands of Pennsylvanian age: the Gunsight and Thomas sands in Archer, Baylor, Jack, Young, and Southern Wichita counties; and the Thornberry, Burk and other unnamed Cisco sands in Northern Clay and Wichita counties. Canyon sands of Pennsylvanian age are being repressured at the Chalk Hill Field in Archer County and in Cooke and Montague counties.

Cost Nominal

Because gas injection into the shallow sands of North Texas seldom requires high pressure and usually the injection volume is not large, the cost of repressuring has been nominal. General practice has been to install a small, single-stage or two-stage compressor in the central power building so that it can be operated by the pumping engine. Suction lines from the compressor to the casingheads of the producing wells, discharge lines from the compressor to input wells, and necessary gas scrubbers, accumulators, and metering equipment are about all of the repressuring equip-

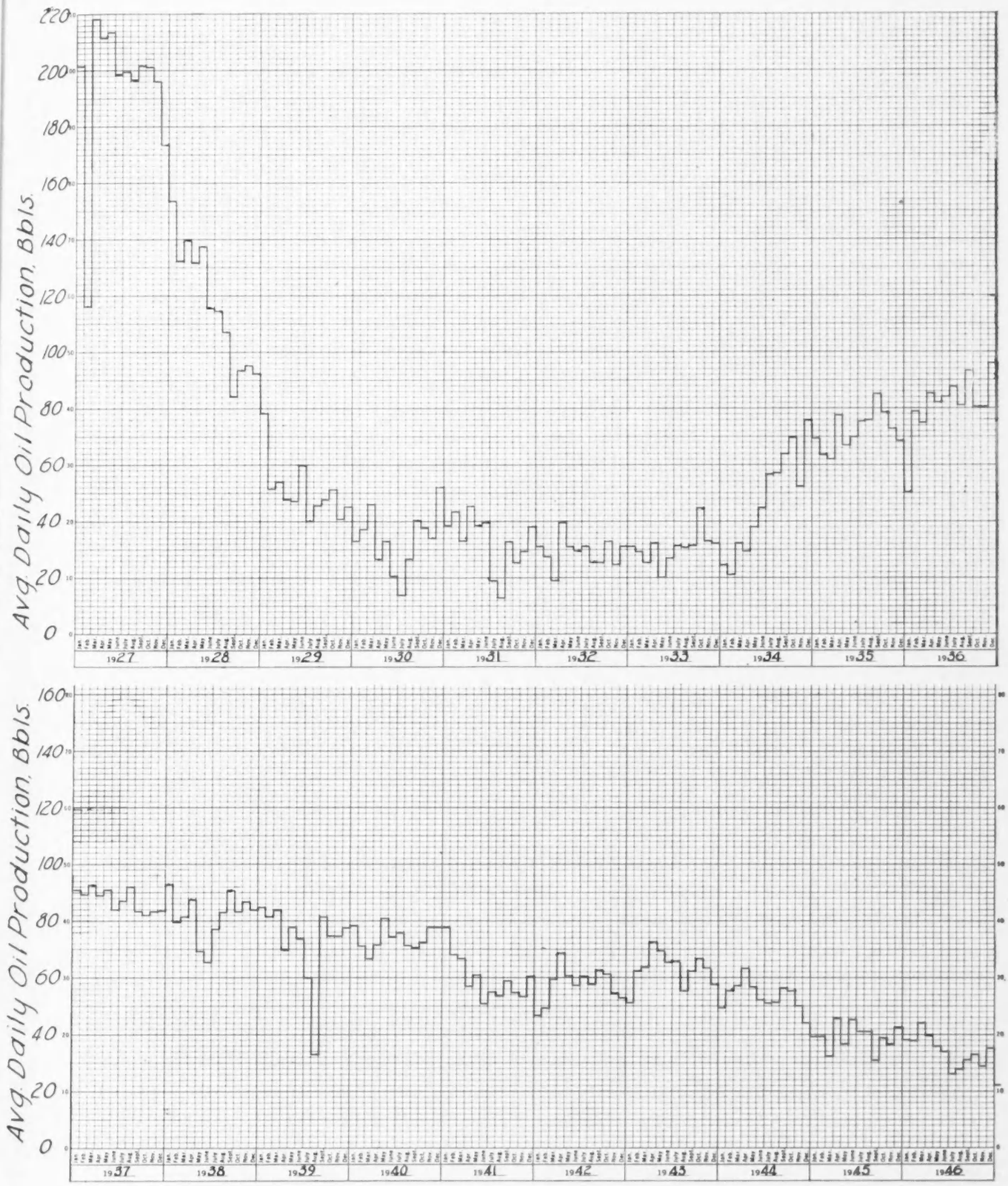


FIGURE 5. Lease "B," Archer County, Texas.

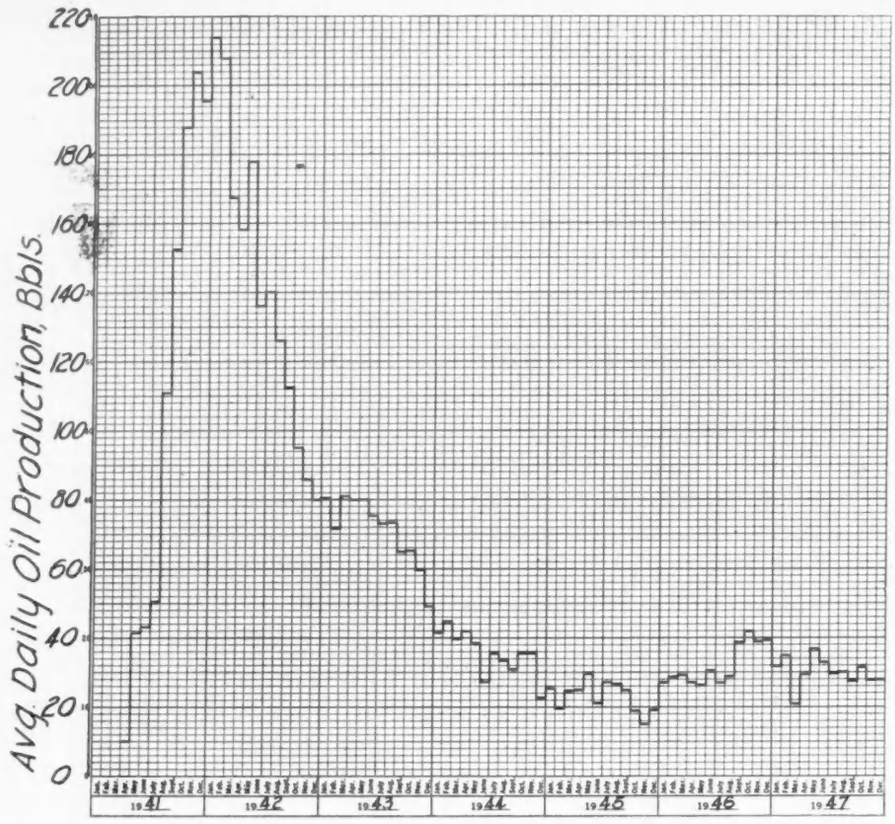


FIGURE 6. Lease "C," Clay County, Texas.

ment necessary in addition to the compressor. Usually one or more producing wells are converted to input wells.

Perhaps some comment should be made concerning the meaning of the term "gas repressuring." It has been used in North Texas to describe gas injection into any low pressure formation, regardless of whether or not there was any appreciable restoration of reservoir pressure, and is so used in this paper. The term seems justified because the process does restore a pressure differential from a point in the reservoir to the producing wells.

Mercer Project

The only actual repressuring project of record in North Texas, if we take the term literally, was in the Mercer or Olney Field just north of the city of Olney in Young County. This field produces from a lens of Gunsight sand at approximately 1050 feet. Productive area is about 80 acres, and average sand thickness, 19 feet.[3] Figure 1 is a structure map of the field contoured on top of the producing sand. Comparison of Figure 1 with Figure 2, which is a sand thickness map, shows that much of the structural relief is due to thickening of the sand. Dry holes surrounding the field indicate that the sand lens probably is closed on all sides by impervious shale. The field was developed in 1925 and 1926 by the drilling of 26 producing wells with initial productions ranging up to 500 barrels per day. By November, 1929, the field had produced over 358,000 barrels and had declined to a daily production of 47 barrels from the 21 remaining wells. Humble Oil & Refining Company owned the Mercer lease and acquired the Hausler lease for the purpose of using the field for experimental gas repressuring. All wells were closed in, and gas injection was started into several wells in January, 1930.[3] By October, 1930, 107 million cubic feet of gas had been injected, raising the bottom hole pressure to 415 pounds per square inch, at which time gas injection was discontinued and the field remained closed in for a year to allow the reservoir pressure to reach equilibrium. During this year the bottom hole pressure declined to 354 psi.

Production was resumed in December, 1931, by flowing at restricted rates, and in January, 1932, 2 million cubic feet of additional gas were injected. Production continued as shown by Figure 3 with all produced gas being returned to the sand until 1936, after which time lease gas was used for fuel with all excess gas being re-injected.[4]

Total Yield

Total production since repressuring has been 248,000 barrels. Per acre recovery before repressuring was 4370 barrels; after repressuring, 3100 barrels; total, 7470 barrels, an increase over primary recovery of 69 percent. Since the operation following repressuring closely simulates production of a flush field

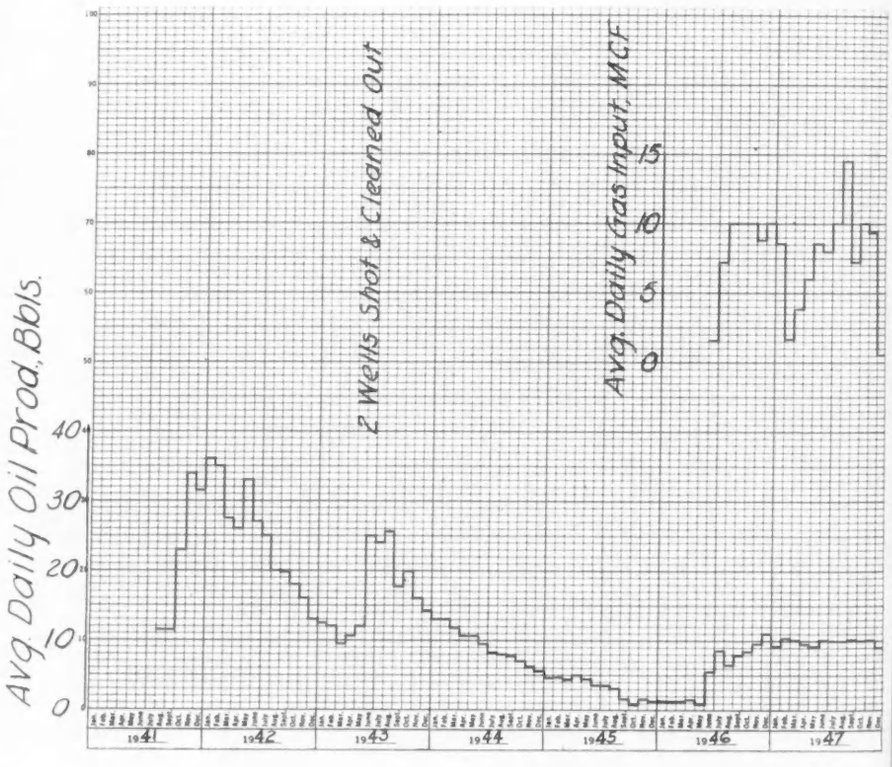
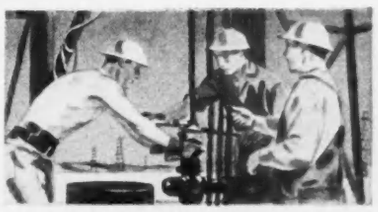


FIGURE 6A. Three wells offsetting injection well, Lease "C."

AXELSON FIRST CHOICE

ROD CREW FOREMEN AGREE there is no better sucker rod than an AXELSON, because 55 years of manufacturing "know how" and the reputation of the industry's pioneer producer of sucker rods is behind every stand they make up.

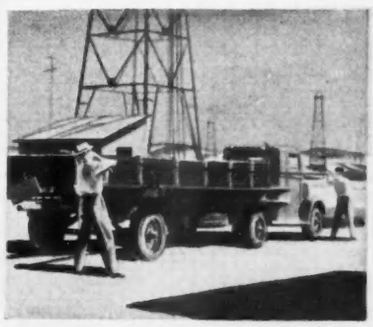
GUARANTEED *MINIMUM* PHYSICAL PROPERTIES give foremen and crew confidence in an AXELSON rod string . . . make it unnecessary to allow for unknown "low limits" . . . descaling after heat-treatment assures absence of hidden surface defects where corrosion can start.



LESS FREQUENT PULLING AND FISHING when AXELSON rods link the plunger to the beam . . . controlled quality sucker rod steels . . . precision machined threads and couplings assure perfect alignment of rod body with pin end . . . scientific heat-treatment gives uniform grain structure and greater strength from end-to-end.

FREE TO PETROLEUM PRODUCTION MEN: *"Not How Much . . . But How Well," a 56-page book tells you the story of* AXELSON'S *sucker rods and couplings. Write today for your copy.*

EASIER TO MAKE UP AND PRELOAD through more care in manufacturing . . . threading after heat-treatment prevents thread distortion . . . accurately machined face of rod shoulder and ground ends on heat-treated couplings, mate and preload perfectly.



IMMEDIATE AVAILABILITY IN ALL FIELDS cuts down-time waiting for rods . . . a size and type of rod and coupling for every pumping load and well condition . . . complete stocks at the "well-side" in most fields, ready for immediate delivery.

AXELSON *Sucker Rods*

THERE IS NO ECONOMICAL SUBSTITUTE FOR QUALITY

PROVED DEPENDABILITY FOR OVER HALF A CENTURY

AXELSON MANUFACTURING CO. • **PLANTS**—Los Angeles 11; St. Louis 16 • **OFFICES**—New York City 7; Tulsa 1; Buenos Aires, Argentina; Caracas, Venezuela • **DISTRIBUTORS**—Jones & Laughlin Supply Company; Great Northern Tool & Supply Company; C. C. McDermond, Maracaibo, Venezuela; Industrial Agencies, Ltd., San Fernando, Trinidad, B.W.I.; Industrias Waldrip & Campbell, Caracas, Venezuela.

with all produced gas being returned to the sand, this project is an excellent example of the benefits to be derived from early gas injection.

Successful Operations

Some examples of successful gas repressuring operations in which the reservoir pressure was not restored are described briefly below.

Lease "A" Young County, produces from the Gunsight sand at a depth of 800 feet. There are six producing wells and one gas input well. The productive area is approximately 20 acres; average sand thickness, 20 feet. As shown by Figure 4, production from the lease declined from about 80 to 15 barrels per day in three years. Gas injection was started in September, 1930, with from 1000 to 4000 cubic feet per day being injected into one well. As shown by the production curve, response was immediate, and over 43,000 barrels of oil have been recovered as a result of gas injection.

Lease "B," Archer County, produces from the Gunsight sand at an approximate depth of 1300 feet. The 28 producing wells drilled in 1924 and 1925 developed a productive area of approximately 100 acres with average sand thickness of 13 feet. As shown by Figure 5, production declined from 218 barrels per day in March, 1927, to 14 barrels per day in July, 1930. Gas injection started in 1932 or 1933 increased the rate of production to about 90 barrels per day in 1937. No records are available concerning the early gas injection, but for the past several years, total injection volume has been 80,000 to 100,000 cubic feet per day. At present there are 18 producing wells and three gas injection wells. Total production from the lease has been about 800,000 barrels, of which about 275,000 barrels were due to gas injection. It is estimated that over 40 percent of the original oil in place has been recovered.

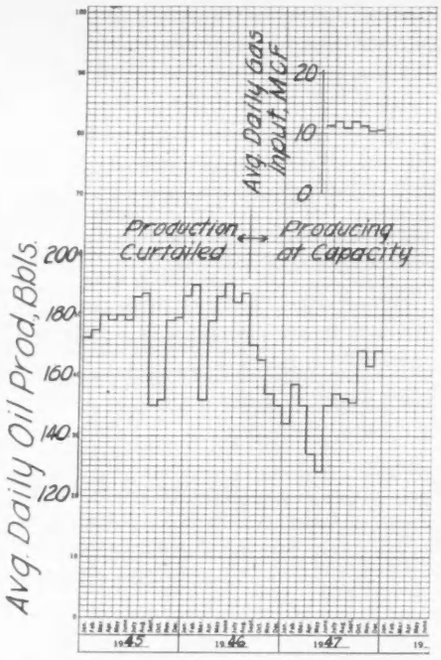


FIGURE 7. Lease "D," Clay County, Texas.

Lease "C," Clay County, produces from the Thornberry sand at a depth of 1100 feet. There are 19 wells on about 55 productive acres. As shown by Figure 6, the production declined rapidly from 214 to about 20 barrels per day. Some of the produced gas was returned to the sand early in the life of the lease, but it seems to have had no effect upon the production decline, probably because of insufficient injection volume. In 1946 outside gas became available, and rate of injection was increased. The production curve indicates that a substantial amount of oil will be recovered as a result of gas injection. Figure 6-A shows the production record of three of these wells offsetting an injection well on which records are available. Injecting 10,000 cubic feet per day into this well increased production from the three offset wells from two to ten barrels per day.

Lease "D," Clay County, produces from the Thornberry sand at a depth of 1100 feet. There are 14 producing wells on this lease, only five of which are being affected by gas injection. As shown by Figure 7, the lease was producing at the allowable rate until September, 1946, at which time production started declining rapidly. One well was converted to an injection well in June, 1947, with 11,000 cubic feet per day of produced gas being injected. As a result, the production rate was increased from 128 to 168 barrels per day. The increased production due to repressuring during the six months since gas injection commenced has more than paid the total capital investment in repressuring equipment. Operating expense of repressuring has been negligible.

Effect of Proper Control

Figure 8, showing the average daily production from a group of leases in the Ranger District, Stephens and Eastland counties, is presented to illustrate the effect of proper control of injected

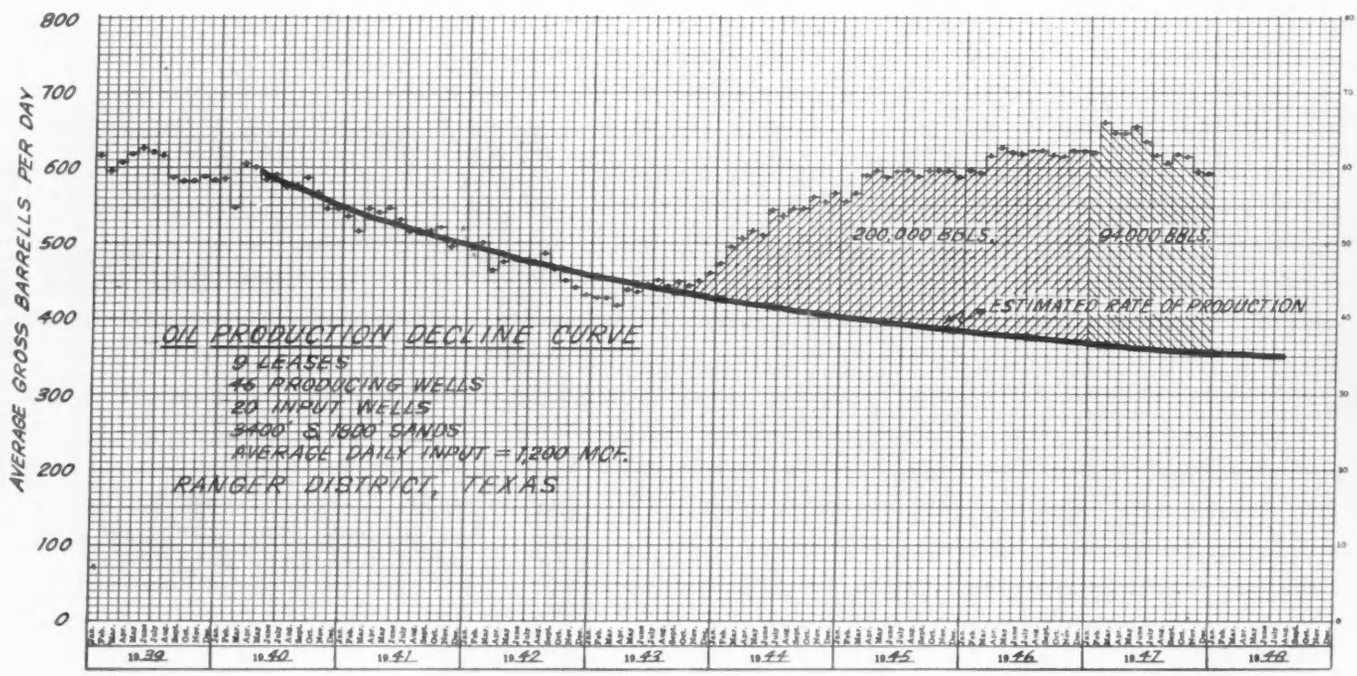
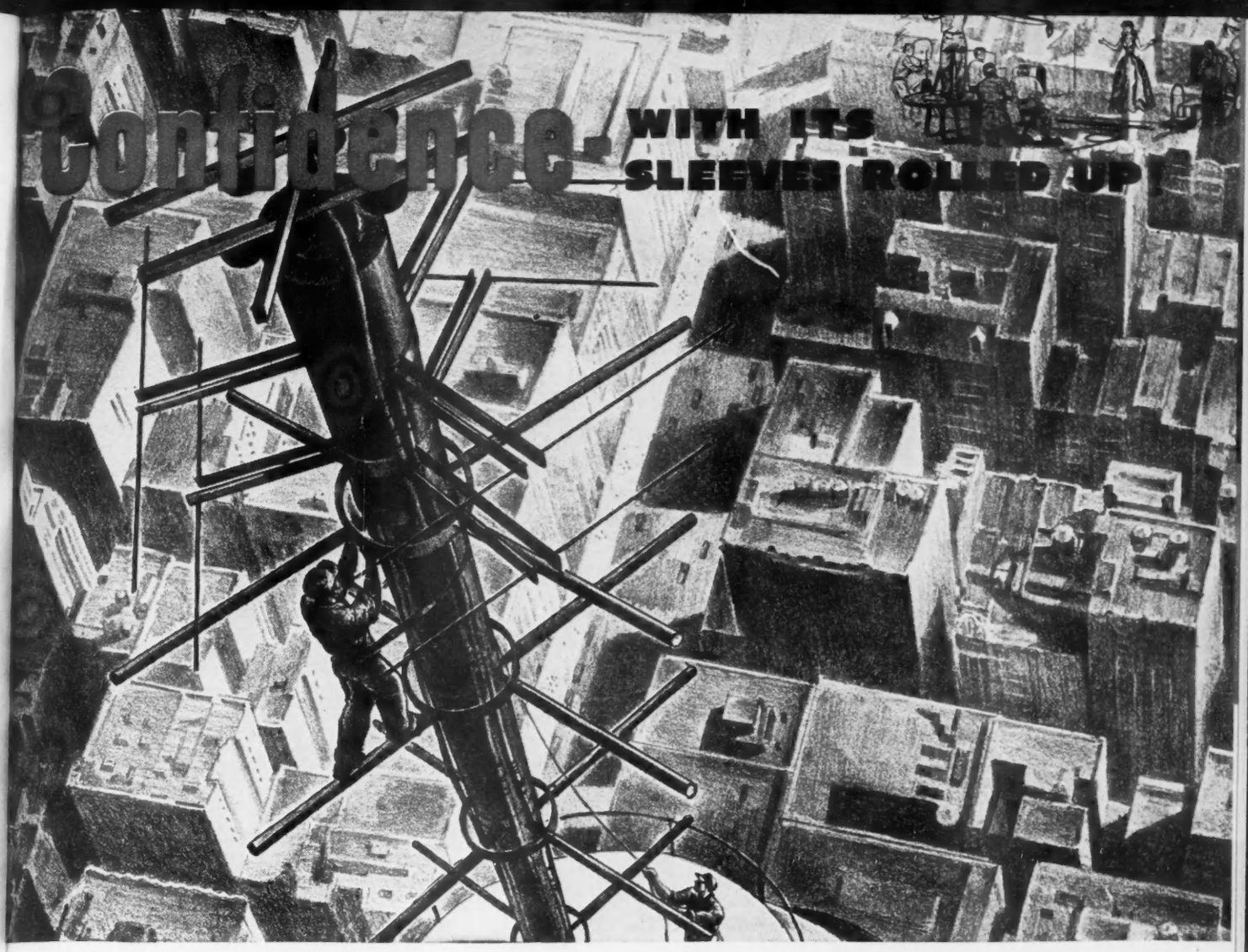
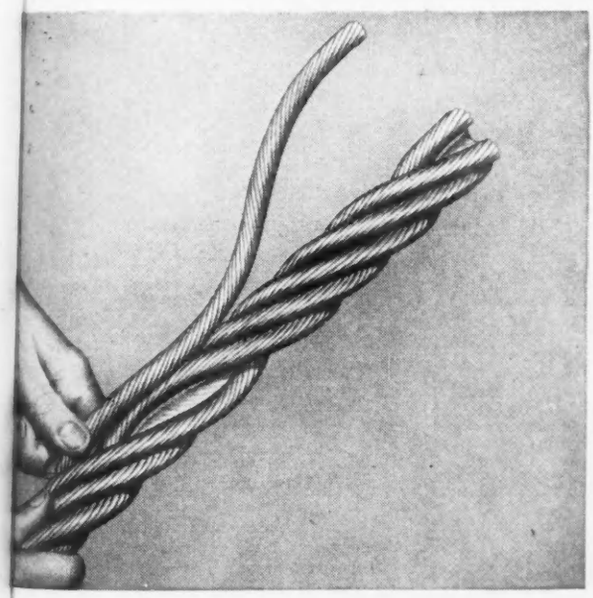


FIGURE 8





ATOP THE WORLD'S TALLEST BUILDING . . . yet not high enough! Television's need for unobstructed, long-range broadcasts may be met by planes in the stratosphere, relaying signals from the earth. Engineers working on this problem are confident of ultimate success.

With like confidence, Roebling blazes new trails in developing and making products vital to communication and all other industries. And the widespread confidence reposed in Roebling is our most guarded asset. Leadership is maintained only by constant progress . . . our ideal is to make Roebling products and engineering service the best obtainable anywhere, *any* time.

WHEN TO SPECIFY ROEBLING *Preformed* WIRE ROPE

WHEN IT WILL SAVE YOU MONEY is the time to specify Roebling Preformed Wire Rope. Wherever wire rope is subjected to severe bending, Roebling Preformed is an outstanding money-saver. On thousands of installations it lasts far longer than Non-Preformed ropes . . . pulls down performance costs to an all-time low.

Great resistance to fatigue from bending helps give Roebling Preformed a long life, but you can chalk up other big advantages. Preformed is not inclined to twist and kink . . . is easy to handle and install. It can be cut without seizing. Broken wires lie flat . . . don't injure hands or chew up drums and sheaves.

Get your Roebling Field Man's advice about Preformed and the possibility of its saving you money. You can act on his suggestions with full confidence for he *knows* wire rope, how to choose the *right* one, how to maintain it for top service. Write or call him at your nearest Roebling branch office.

JOHN A. ROEBLING'S SONS COMPANY
TRENTON 2, NEW JERSEY
Branches and Warehouses in Principal Cities

Distributed by: **The National Supply Company**
Republic Supply Company

ROEBLING

JR ROEBLING

★ *WIRE ROPE AND STRAND* ★ *FITTINGS* ★ *SLINGS* ★ *SUSPENSION BRIDGES AND CABLES* ★ *AIRCORD, AIRCORD TERMINALS AND AIR CONTROLS* ★ *AERIAL WIRE ROPE SYSTEMS* ★ *ELECTRICAL WIRE AND CABLE* ★ *SKI LIFTS* ★ *HARD, ANNEALED OR TEMPERED HIGH AND LOW CARBON FINE AND SPECIALTY WIRE, FLAT WIRE, COLD ROLLED STRIP AND COLD ROLLED SPRING STEEL* ★ *SCREEN, HARDWARE AND INDUSTRIAL WIRE CLOTH* ★ *LAWN MOWERS*

gas. These nine leases, comprised of 46 producing wells and 20 input wells, were developed in the early 1920's. The majority of the wells are producing from the 3400 foot sand (main Ranger pay); however, 14 of the producing wells and six of the input wells are completed in the 1800 foot shallow sand.

Gas injection was started on some of the leases in 1937 and 1938 and was expanded to include all nine leases by 1939. In August, 1943, a consulting engineer was employed by the operator to study the repressuring system and to recommend any changes necessary for improved operation. In September the total daily production was 450 barrels per day. As a result of adjusting the input volumes, controlling the produced gas and adding a few input wells, the production increased to a peak of 660 barrels per day in February, 1947. The input pressures vary from 5 psi to 50 psi, and the present total volume into all input wells is 1200 (mcf) per day. The cost of the input gas is nominal. Revenue derived from the sale of cas-

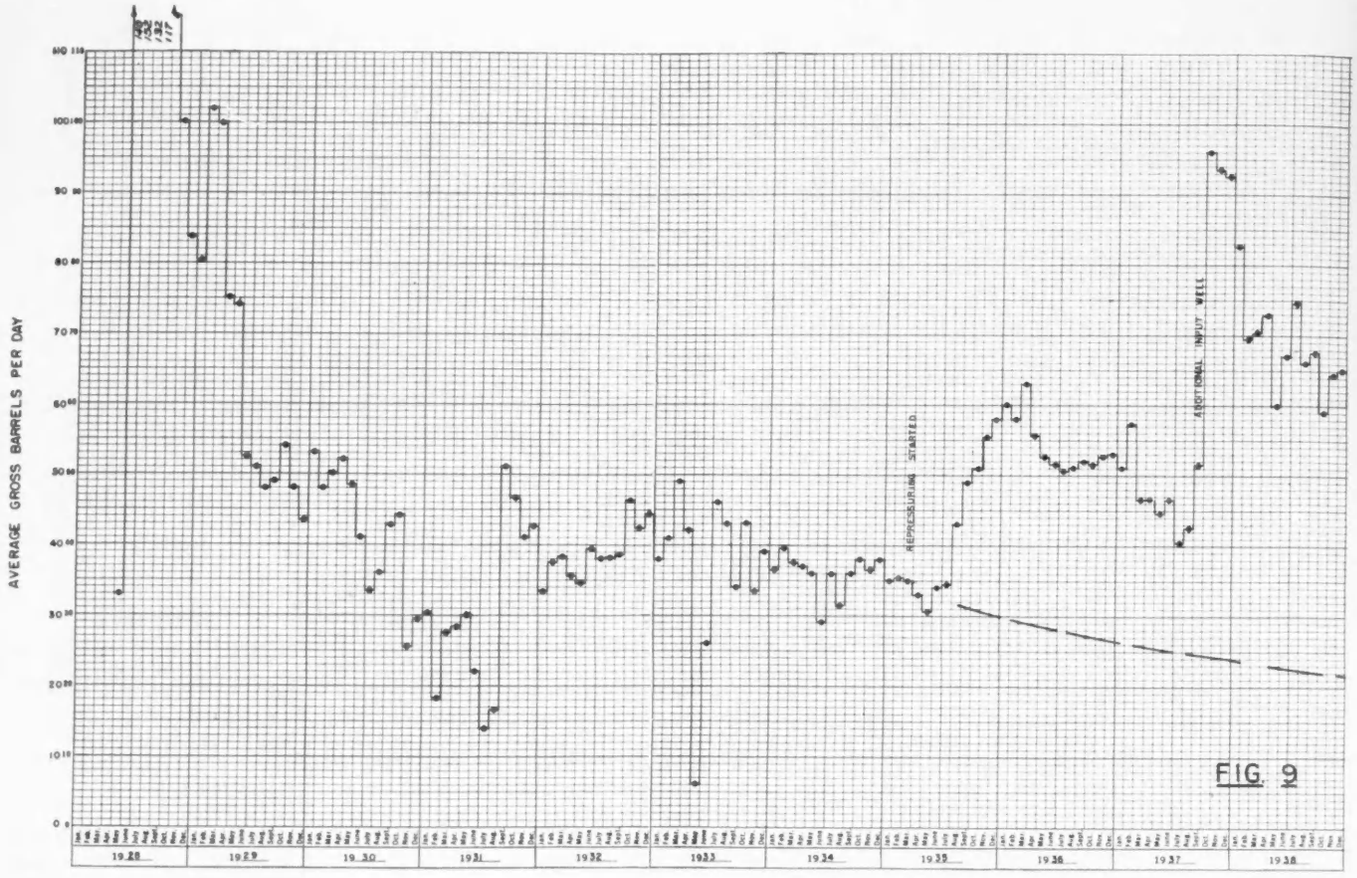
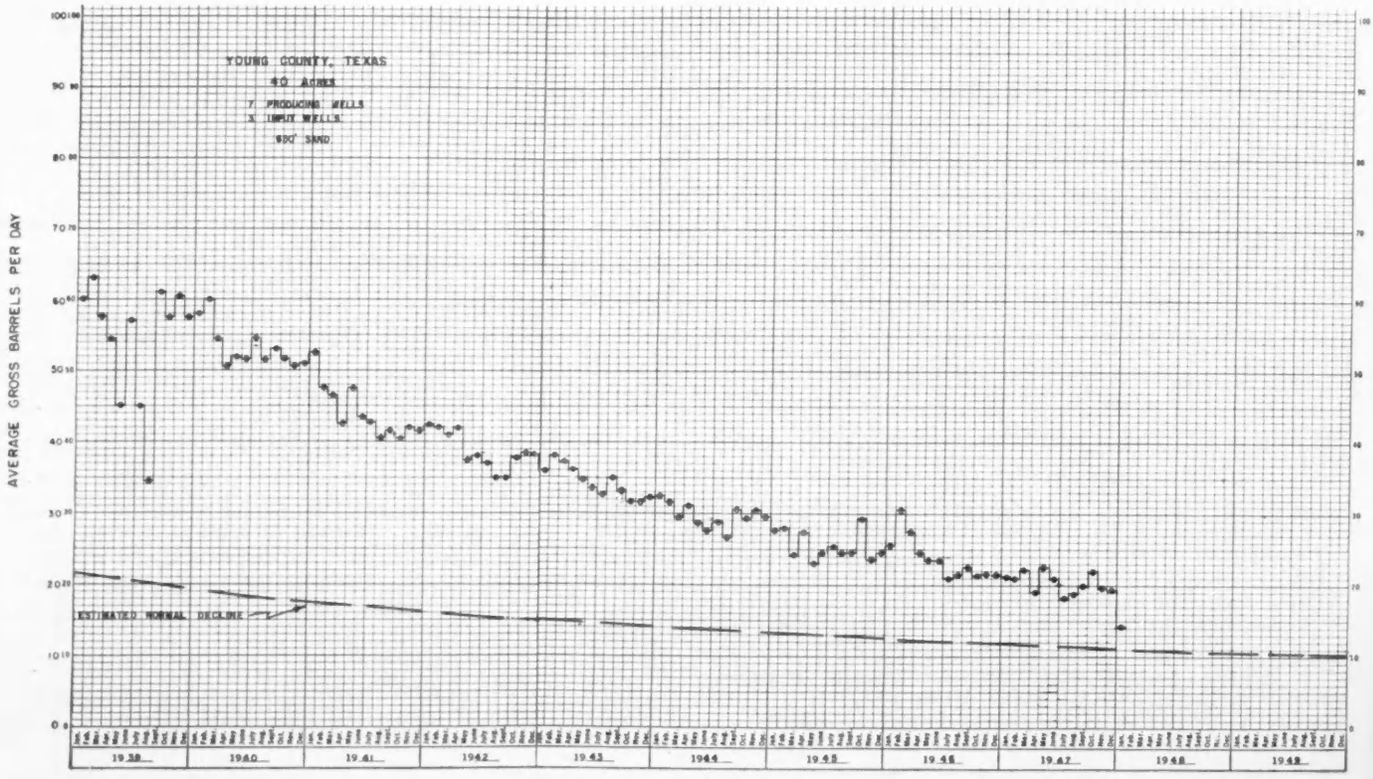


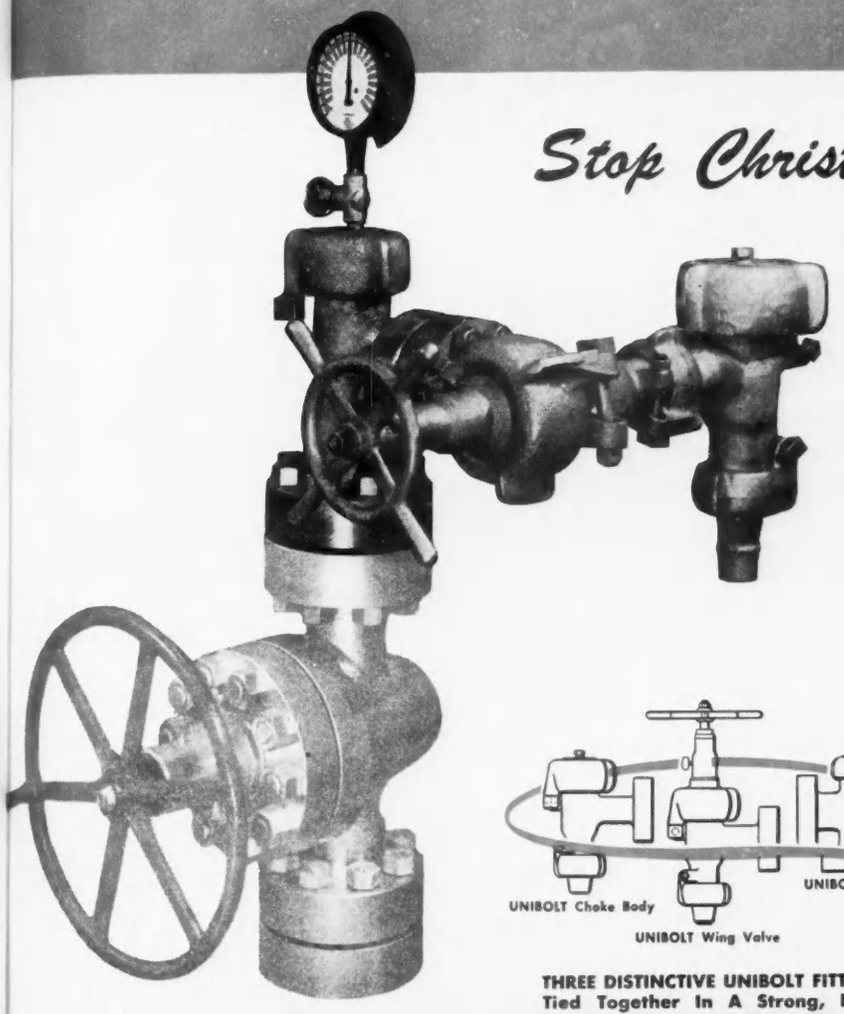
FIG. 9



UNIBOLT FLOW MANIFOLDS

in CORROSION-RESISTANT

HIGH-CHROME ALLOYS

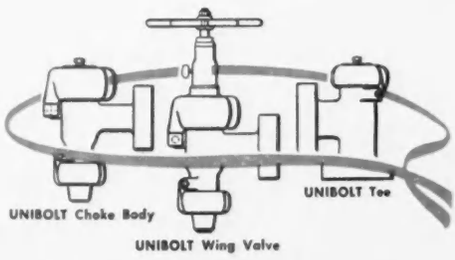


Stop Christmas Tree Corrosion!

Several years ago when the industry developed a market for gas-distillate production, UNIBOLT engineers initiated a research program to develop a corrosion-resistant alloy for Christmas tree flow wings. A number of stainless steels with varying heat treatments were investigated, but laboratory tests on one particular high-chrome alloy demonstrated unusually good corrosion-resistant qualities.

Test installations of UNIBOLT fittings from this alloy were begun nearly three years ago on wells where ordinary steel fittings had become extremely corroded in as little as 40 days. Recent inspections reveal that the corrosive gas-distillate flow from these wells has had absolutely no effect on the UNIBOLT high-chrome fittings.

Complete UNIBOLT Flow Wings (see illustration) are now offered in this same corrosion-resistant alloy in 5000 and 10,000 lbs. working pressure and in carbon steel in 3000 and 5000 lbs. working pressure. Because UNIBOLT Flow Wings are stronger, yet eliminate much of the bulk and weight of conventional Christmas tree wings, they are both safer and more economical.



THREE DISTINCTIVE UNIBOLT FITTINGS Tied Together In A Strong, Light-Weight, Pre-tested Flow Manifold.

THORNHILL-CRAVER COMPANY

HOUSTON, TEXAS

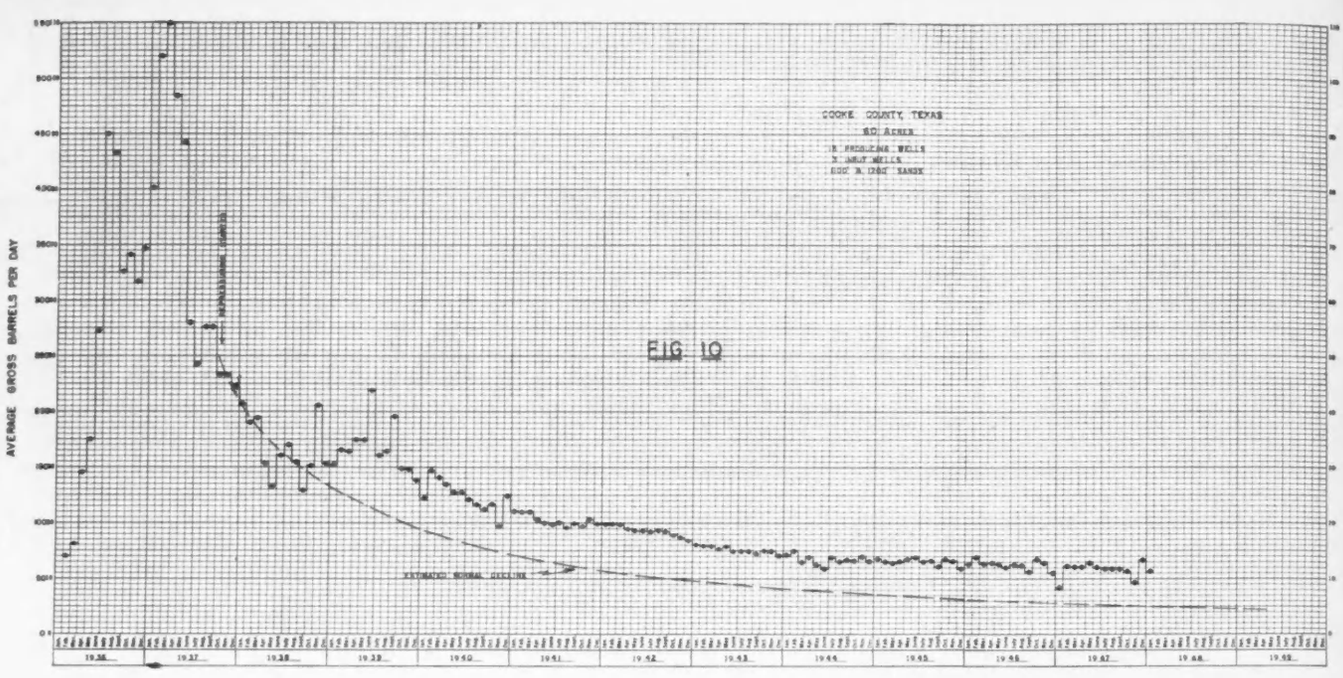


FIG 10

inghead gas from these leases is $3000 per month above the cost of the injected gas. It is estimated from the decline curve that from June, 1943, until January 1, 1948, these leases have produced 294,000 barrels of oil more than previously expected recovery.

Figure 9 shows the production history of a shallow lease in Young County. The lease was drilled in 1928 and produces from the Gunsight sand at a depth of approximately 650 feet. Eight wells were drilled on the 40-acre lease, and maximum production of 152 barrels per day was obtained in July, 1928. The rate of production declined rapidly to a low of 14 barrels per day in July, 1931. Apparently, in 1931 the wells were reconditioned and production was increased to approximately 50 barrels per day. The lease continued producing at a normal rate of decline until repressuring was started in March, 1935. The original compressor installation consisted of a small vertical compressor with a capacity of 30,000 cubic feet per day which was driven by the power engine. The third month after gas injection was started into two input wells, the production responded favorably to gas injection and in 10 months increased to 63 barrels per day. In September, 1937, an additional producing well and

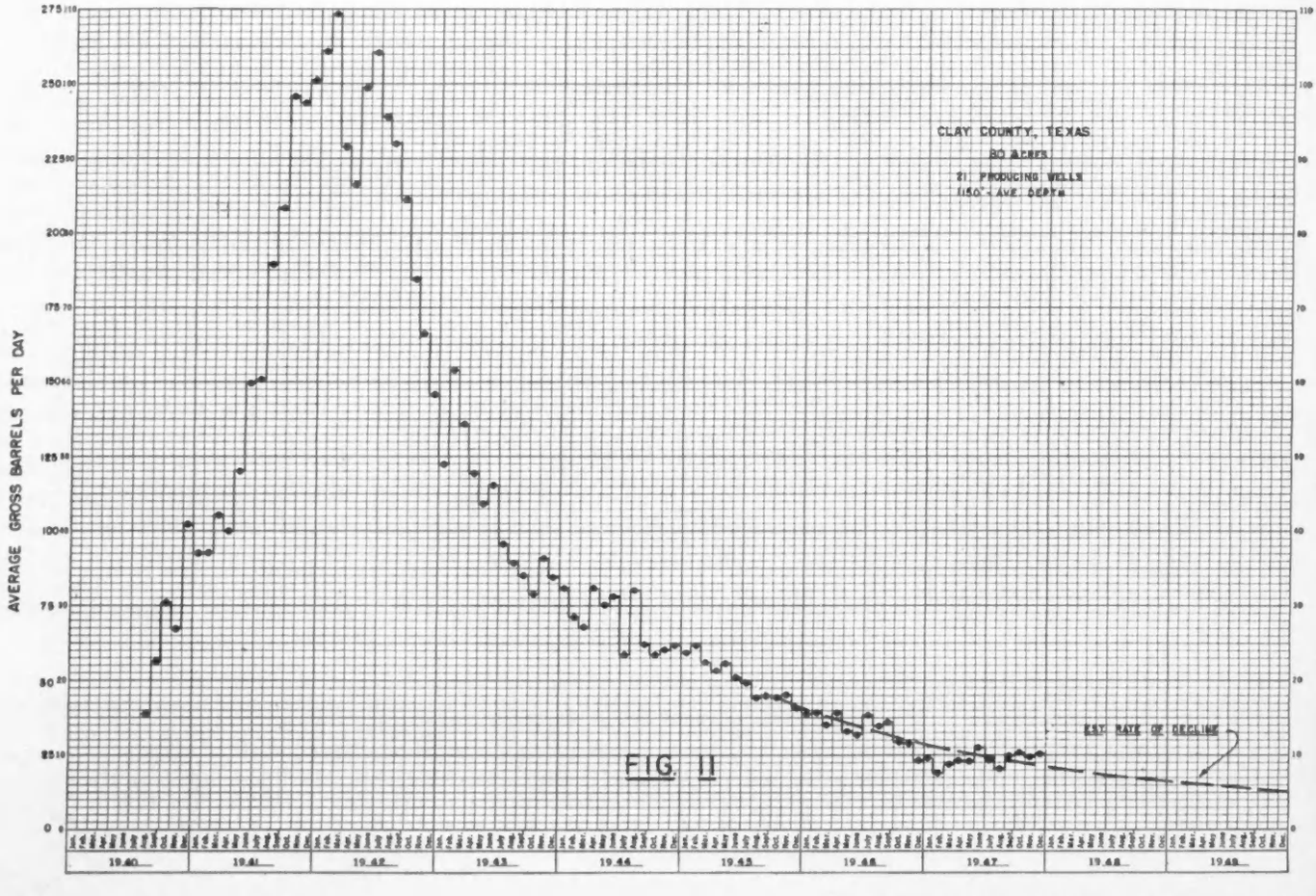


FIG 11

Now Available
THE NEW D+B STAINLESS STEEL "Endurall" PUMPS

THE ANSWER TO YOUR CORROSIVE AND ABRASIVE PROBLEMS

Every production man will want to know about the new D+B stainless steel "Endurall" pumps. For here is a completely new line of deep well plunger pumps designed and proven to withstand the most severe pumping conditions. A special new stainless steel alloy makes these pumps unbelievably resistant to both corrosion and abrasion. Combine with this, the D+B advanced design, precision workmanship and rigid shop inspection, and you have the reasons why production men are acclaiming the new "Endurall" pumps as the finest obtainable at any price. Ask your D+B field representative for complete information. Complete pumps, or replacement parts for your pumps now in service are available for immediate delivery. Made to A.P.I. specifications. Investigate today to increase your pumping profits tomorrow!

THESE EXCLUSIVE FEATURES MAKE D+B "Endurall" PUMPS OUTSTANDING IN THE FIELD FOR SEVERE PUMPING SERVICE.

LINERS

A special stainless steel makes liners both corrosion and abrasion resistant. Centrifugally cast and honed to a mirror-like finish, they have precisely-controlled hardness for maximum wear resistance.

PLUNGERS

Plungers are available in plain steel chrome-plated and stainless steel types, grooved or non-grooved, as desired. They are precision ground and polished to insure a perfect, lasting seal.

CAGES

Cages are scientifically designed to provide correct ball lift and clearance. They are heat-treated and flame-hardened to withstand pounding and spinning action of ball.

BALLS & SEATS

Seats are individually lapped in a special machine to insure perfect fit with ball. Each ball and seat is vacuum tested to guarantee its perfection.

D+B Stainless Steel PUMPS

CONTINENTAL

SERVING THE OIL AND GAS INDUSTRIES

THE CONTINENTAL SUPPLY COMPANY

General Offices: DALLAS, TEXAS • Export Division: 30 ROCKEFELLER PLAZA, NEW YORK, N. Y.

an input well were drilled on the lease; and the first month after gas was injected, the production increased from 52 to 96 barrels per day. Since October, 1937, the production decline has been nominal, and the ten-well lease is now producing 20 barrels per day. Total recovery from the lease has been about 302,000 barrels, of which it is believed 109,000 barrels were the result of repressuring.

Figure 10 is the production curve of a lease in Cooke County which produces from two Cisco sands at 1100 and 1200 feet. The first well was completed in February, 1936, and by February, 1938, the development was complete. The 18 producing wells attained a maximum production of 550 barrels per day. In October a small compressor plant consisting of a 25-horsepower engine and a 6½x2¼x5½-inch vertical, two-stage compressor was placed in operation and gas was injected into both producing sands. At the start of the operation total produced gas was less than 50 cubic feet per barrel. Both the compressor and the power engines were operated on fuel oil and all produced gas was returned to the reservoir. By October, 1938, the production decline curve showed a definite flattening. In 1939 the produced gas was supplemented with purchased gas, and an over-all input gas-oil ratio of approximately 400 cubic feet per barrel has been maintained to the present date.

From the decline curve it is estimated that injection of gas into the producing sands has resulted in producing the following amount of oil:

Total production to
January 1, 1948.....582,267 barrels
Estimated recovery without repressuring.....376,000 barrels
Increased recovery by repressuring .....206,267 barrels

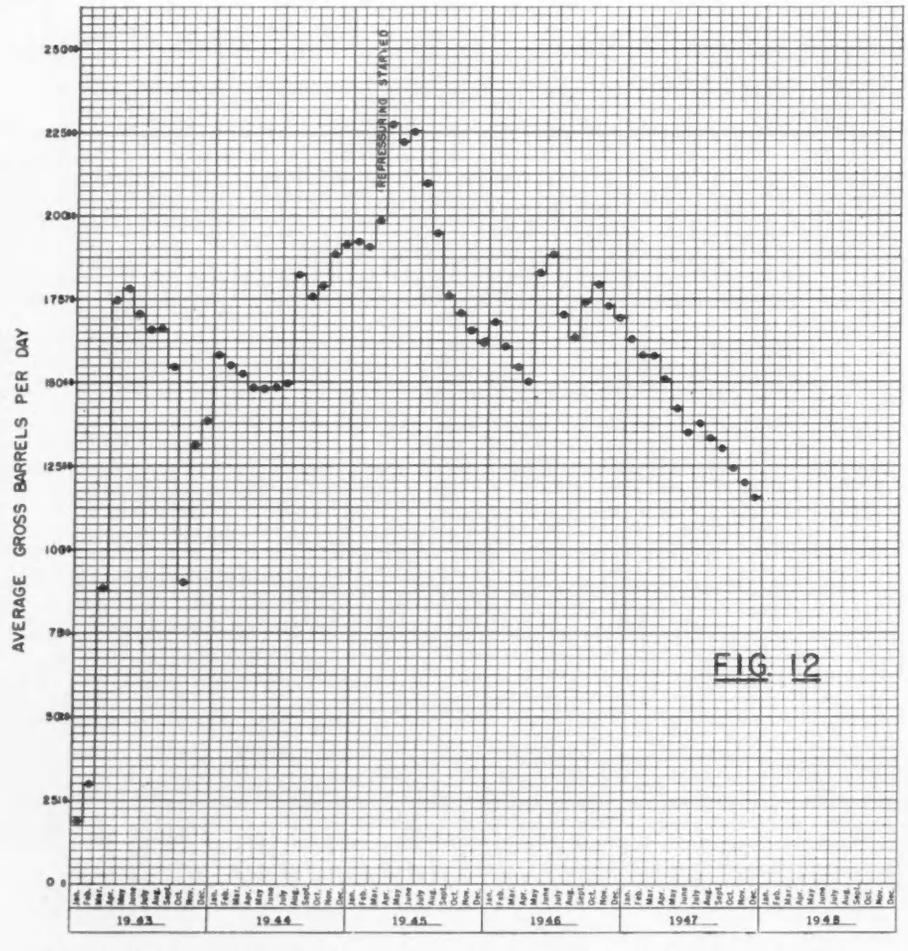
Figures 11 and 12 show a comparison of the production histories of two leases: one produced to depletion without gas repressuring and the other subjected to gas injection early in its productive life. The curves shown in Figure 11 represent the production of a 21-well, 80-acre lease in the Thornberry district, Clay County. The wells are producing from the 1150 foot Cisco sand and have never been operated under repressuring. The curve shows that development was completed in June, 1942, and that a peak of 270 barrels per day was attained in February, 1942. Since June, 1942, production has experienced such a rapid rate of decline that in December, 1947, the average daily production was only 25 barrels, or 1.2 barrels per well. To January 1, 1948, the entire lease had produced 254,000 barrels of oil, or 12,095 barrels per well.

Figure 12 depicts the production history of a 19-well, 80-acre lease, also located in the Thornberry district, Clay County, in close proximity to the lease shown by Figure 11 and producing from the same horizon; however, gas injection was commenced early in the productive life of this property. The first well was completed in January, 1943, and, with the exception of one producing well and one input well drilled in April, 1946, development was completed by August, 1944.

In February, 1945, a new central power and a 5x2x4-inch vertical, two-stage compressor were placed in operation, and gas was injected into three input wells. The original gas-oil ratio was approximately 250 cubic feet per barrel, and all produced gas in excess of the fuel requirements was returned to the producing sand. In 1946, upon completion of the new wells, it became necessary to add a 4½x1⅞x4-inch two-stage compressor to continue the return of all produced gas to the sand.

This lease has produced 284,000 barrels of oil, or 14,950 barrels per well, and still produces at the rate of six barrels per well per day; whereas the non-repressured lease produced only 12,095 barrels per well and is now producing only 1.2 barrels per well per day.

As indicated by the title of the paper, only successful gas repressuring operations have been discussed. There have been many that were not so successful. The rather common practice of selecting as the injection wells the least productive wells on a lease, and the lack of attention to proper control of injected and produced gas have been responsible for the failure of some projects. Lack of available gas has seriously handicapped many projects. It appears certain, however, that, with adequate supervision, gas repressuring will recover much oil that would otherwise never be produced.



Clay County, Texas; 80 acres, 15 producing wells, 4 input wells, 1150 feet average depth.

ACKNOWLEDGMENT

The authors gratefully acknowledge the assistance rendered by Albert Crenshaw concerning the early history of repressuring in North Texas, and the invaluable cooperation given by Jo H. Cable, his staff, and the producing companies who furnished data for this paper.

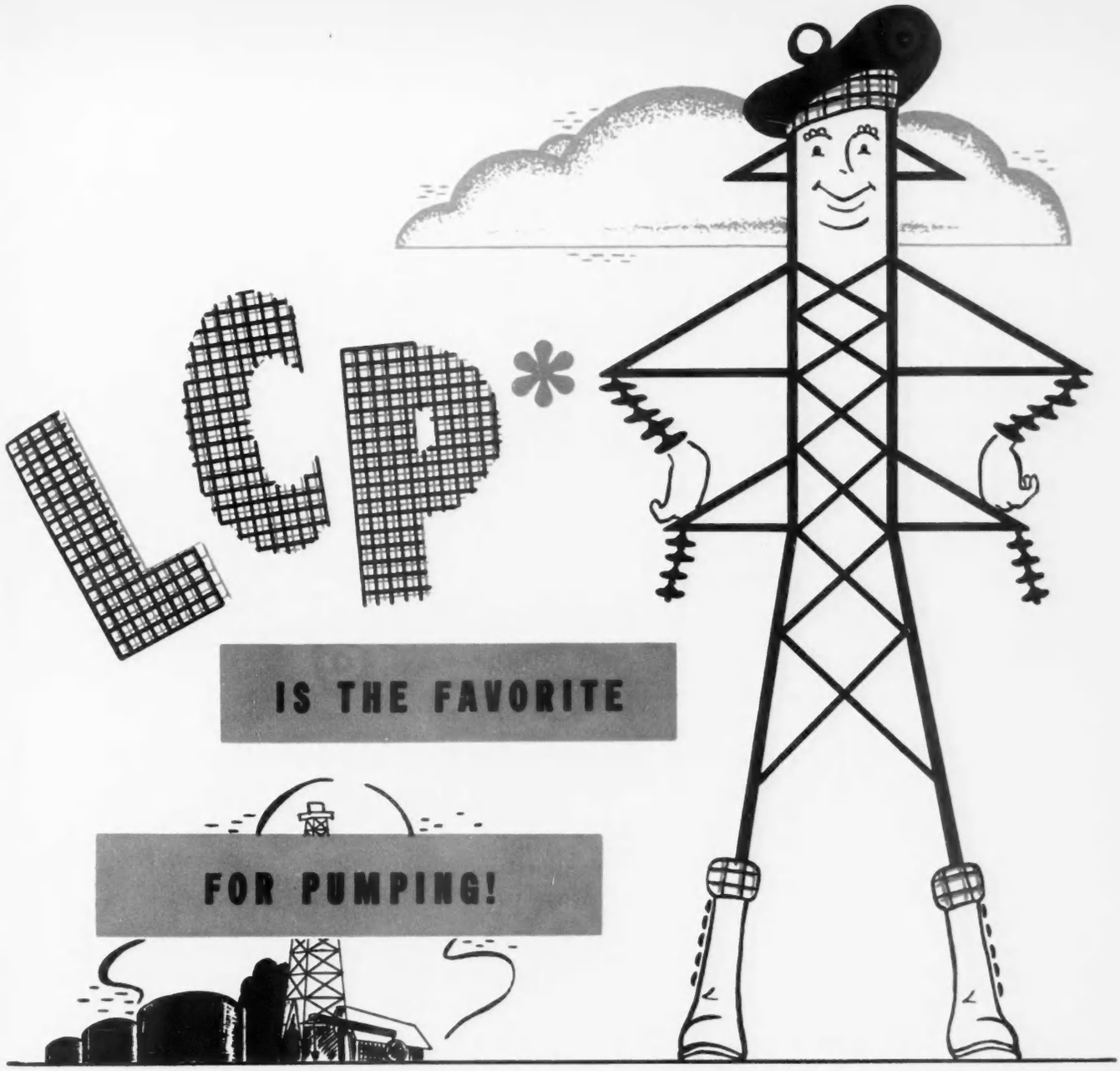
REFERENCES

[1] Jo H. Cable, "Gas Repressuring in the State of Texas," Chapter 20 of "Secondary Recovery of Oil in the United States," API, 1942.

[2] L. F. Peterson and Lee Flood, "Inventory of Gas Drive Operations in North Texas, West Texas and New Mexico," presented at the Spring meeting of the Southwestern District API Division of Production, Fort Worth, Texas, March 27-28, 1947.

[3] H. D. Wilde, Jr., "A Repressuring Experiment Project to Measure the Effect of Early Gas Injection," in "Improvement in Production Practice," API Bulletin 206, 1930.

[4] From the files of the Humble Oil and Refining Company.



LCP—LOW COST POWER—fits pumping requirements perfectly. Costs for operation, maintenance and labor are all considerably less with Utility Electric Power. Automatic controls and fast starting in all weather make pumping schedules easier to maintain. Easy portability lets you get more work from each piece of equipment. Add safety and flexibility and you have power that knows no equal. Get the facts! Ask your nearest Utility Electric Power Company to send over the Power Engineer.

Yesterday's low price—Today's high value!

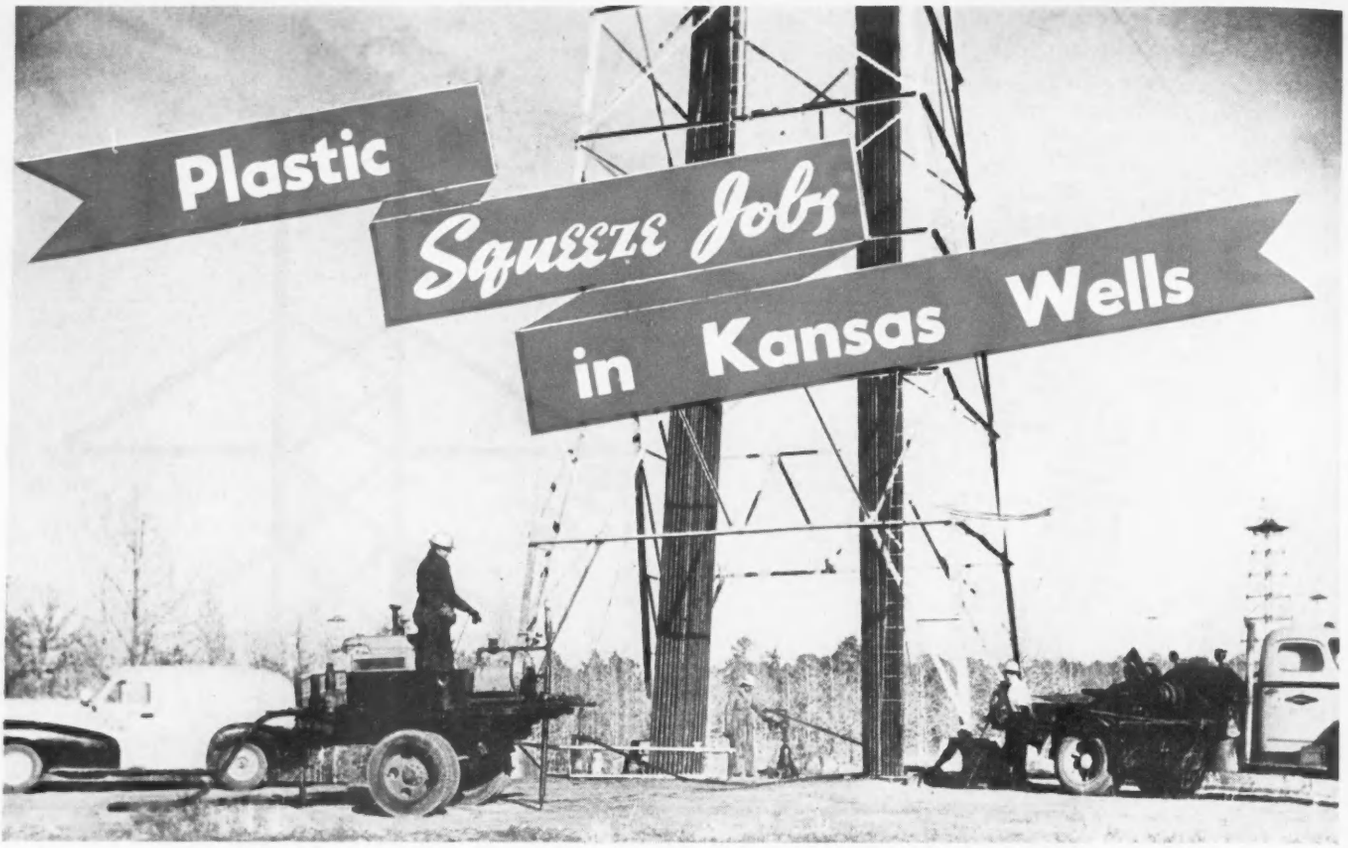
Use Utility Electric Power!

PETROLEUM ELECTRIC POWER ASSOCIATION

Utility ELECTRIC POWER

Box 1498, Oklahoma City, Oklahoma

Plastic Squeeze Jobs in Kansas Wells



When plastic is applied to wells by the bailer dump technique, a specially designed bailing unit, power pumping unit and necessary measuring equipment are used. The power pumping unit has both a centrifugal and a triplex pump enabling it to pump either at high volume or against pressure.

By L. L. TERRY
Service Engineer, Dowell Incorporated

WATER SHUTOFF failures due to cement channeling at the casing shoe are quite common in Kansas well completions, and two or even three squeeze jobs may be necessary before the condition is remedied and the pay zone can be tested. Such remedial work may cost thousands of dollars and constitutes a burden against production which Kansas operators can ill afford due to the low potential of the average producer. A new squeeze technique utilizing plastic instead of cement has recently found successful application in several Kansas fields.

THE use of plastics in remedial well work was first introduced in Kansas by Dowell Incorporated in 1944 at a time when the general public considered plastic the "wonder material" of the century. This mistaken enthusiasm permeated the oil fields and operators accepted it as the final answer to their water troubles. Unfortunately, sufficient engineering was lacking in the early days to insure the proper application of plastics and when this was realized it was found that many jobs had been undertaken which, because of this engineering lack, were foredoomed.

Since the initial "plastics boom" engineers have solved many problems regarding technique in placing plastic in the well bore based on thorough evaluation of reservoir conditions and behavior peculiar to Kansas oil fields. New, improved low-temperature plastic has been developed with different setting characteristics; fillers are now used which reduce the amount of plastic without impairing its strength or plugging characteristics. Most important, however, is the intelligent approach to plug back operations entailing thorough studies of drilling-in records, water analysis, electrical and radiocativity logs, experience gained in plugging back operations in the general area of the well involved, and utilization of water locating and permeability surveys (oil-water interface and spinner). Today, plastic plug jobs seldom fail in the field.

The use of plastics to squeeze off channeled casing shoes is gaining wider application in Kansas becaues of (1) low cost of a plastic squeeze; (2) less waiting time before drilling out; (3) less pressure required to achieve a satisfactory squeeze; (4) the permanance of a plastic squeeze; and (5) continued success in the field.

Adverse Cementing Conditions at the Casing Point

In Central Kansas the principal producting horizon is the Arbuckle Dolomite where the oil-water contact is generally found a few feet below the oil-saturated section of the column. It is obvious, therefore, that a casing program must be carefully prepared and pipe set either on top of the saturated zone or not more than one or two feet within the zone so as to case off as little of the pay as possible. Due to the caving nature of the formations overlying the Arbuckle in the area comprehended by the Barton Arch or central Kansas Uplift, coupled with the shallow casing peneration of the Arbuckle, cement jobs

as a rule will not stand up under pressures required to inject acid in the Arbuckle. Treating pressures vary but generally range from 1700 to 2800 pounds bottom-hole pressure. The conglomerate and lower Kansas City series, which in a few areas immediately overlie the Arbuckle, have negligible rock pressure resulting in a large differential pressure being applied to a short section of cement. As a result, channeling around the shoe occurs frequently and the writer believes this is caused by the reaction of the acid at the shoe and the mechanical breakdown of cement and filter cake due to pressure, and the characteristic sloughing of the unconsolidated formations on top of the Arbuckle which causes a relatively poor bond between the cement and the formation. Once a channel has been created, acid can be easily displaced into some thief formation such as the conglomerate or basal Kansas City and possibly along bedding planes between the Simpson and Arbuckle or into a thin barren zone in the top of the Arbuckle which occasionally is weathered. It can be pumped behind the pipe in a quite definite pressure range from 1700 to 2100 pounds bottom-hole pressure or 500 to 900 pounds casinghead pressure. Rarely is the cement completely circulated around the pipe and cases are on record where the shoe was channeled at less than 300 pounds surface pressure and in some cases the presence of a channel was apparent when the shoe was drilled.

Indications of Channeled Shoes

In the past an operator rarely considered the possibility of a channeled shoe unless one or more of the following conditions existed: (1) badly caving hole; (2) well making water other than from the Arbuckle; (3) rotary mud was entering the well bore; and (4) return of unspent acid after a treatment. While these are all excellent indicators of a channel it is becoming increasingly apparent that channels do exist when none of the above conditions obtains and this has been proved on several occasions by spinning and oil-water interface permeability surveys.

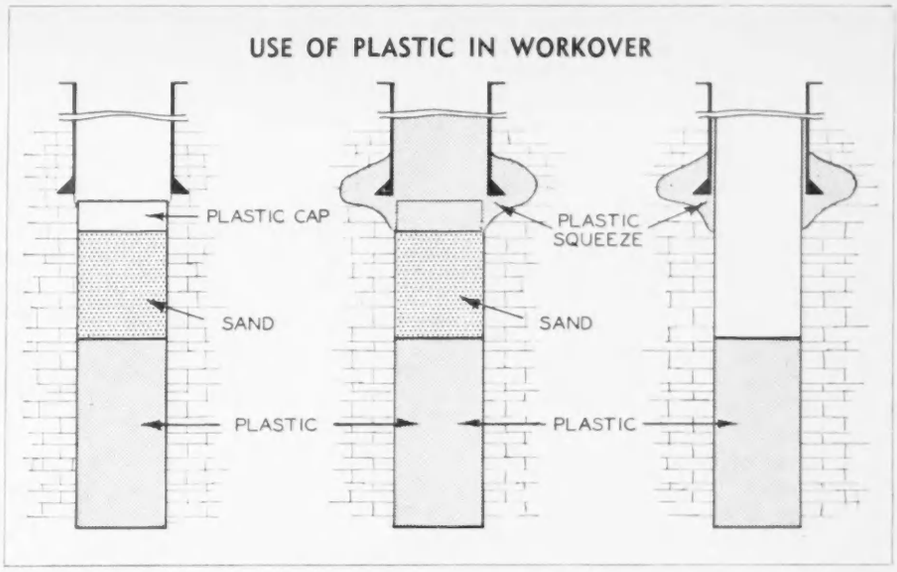
A study of injection rates, pressures and pressure drops during an acid treatment, if carefully and completely made, materially assist in determining the possibility of a channeled shoe. Channeling may be assumed if, during an acid treatment, the following conditions are noted: (1) casinghead pressure of 1200 to 1700 pounds at an injection rate of a quarter-barrel every 15 minutes; (2) a break with casinghead pressure falling gradually or abruptly to 600 to 800 pounds; (3) if acid input can be increased to as high as two barrels or as low as one-half barrel per minute without altering the casing pressure more than 25 to 50 pounds; (4) a gradual pressure buildup, after the break, throughout the remainder of the treatment; (5) a typical pressure drop of 25 pounds in one minute at the end of the treatment, with very little additional pressure drop at the end of five minutes; (6) excessive bleed-back when pressure is released; and (7) no increase in fluid production after the acid treatment.

Such reactions have mistakenly been attributed to the pumping of the acid into a shale formation, and if there was no increase in oil the well usually was abandoned. It is now established that the above characteristics when noted during an acid treatment indicate the possibility of a channeled shoe, and before abandoning his well the operator should check further by running an oil-water interface permeability survey or a spinner-permeability survey to determine definitely whether the acid was injected into the pay or behind the pipe. More than likely he will find that the acid went behind the pipe and the well probably can be saved by squeezing the shoe and acidizing the pay section.

As previously stated, a study of an acid treatment record is fairly reliable in establishing the existence of a channel. However, there are certain areas in the Barton Arch where some wells react under acid treatment in a manner indicating channeling but where acid is actually entering the formation. These areas are well defined, are of low permeability and respond poorly to acid treatment, and while a study of the treatment record is emphasized, the final diagnosis still rests in a permeability survey.

A plastic squeeze unit consists of a truck on which is mounted a reel with 10,000 feet of three-eighths-inch sand line, specially designed bailers for placing sand and plastic on bottom; dual plastics container; electric plastic mixing motor; catalysts and fillers and all necessary connections. In addition there is a "squeeze" trailer equipped with a high capacity centrifugal pump; a small, high pressure triplex pump and internal- combustion motor to furnish the power. The plastic engineer's car is equipped with steel measuring line and metering head.

The operator should prepare for the job by: (1) having the hole cleaned out; (2) setting a mast at the well to support the crown and floor sheaves; and (3) providing a tank with at least 100 barrels of fluid, either oil or water, to be used in displacing the plastic.



On this well a bottom-hole plug (left) failed to shut off the water intrusion. On the basis of a water locating survey, the casing seat was squeezed with plastic (center) accomplishing the desired water shutoff (right).

Squeezing With Plastic

To date, all plastic squeeze work in Kansas has been by the bailer method, i.e., by placing plastic on bottom with a specially designed, positive displacement dump bailer and filling the hole with fluid and applying pressure to displace the plastic behind the pipe.

The first step in squeezing a casing shoe is to determine the total depth of the hole and then to locate the shoe or float collar above it. Measurements are made with a special attachment tied to the end of the steel line. From these measurements the plastic engineer knows the exact footage of open hole and can determine how much of the hole must be plugged back with sand.

The second step is to protect the exposed pay section by packing it off with Ottawa Sand, a fine, very uniform sand which is ideal for this type of work. A specially designed dump bailer is used

to place the sand directly on bottom and after each dump a steel line measurement is made to determine the amount of fillup. When the required fillup has been made, a six-inch to one-foot plastic cap is placed on top and allowed to set, leaving at least one foot of open hole below the pipe.

The third step is to mix ten to 20 gallons of plastic and filler material and spot it on bottom. The hole is then filled with fluid and the plastic displaced behind the pipe with the triplex pump. The plastic is allowed to set for two hours. If any pressure remains in the casing it is released and a steel line measurement made to check the fillup. Generally there is, at the most, a fillup of some six inches. Another ten gallons of plastic are then mixed, the correct amount of filler determined, depending upon well behavior, and the mix is again placed on bottom. This batch is then displaced behind the pipe under pressure which may exceed from 200 to 400 pounds the pressure ordinarily required to displace the batch. After the second displacement casing pressure is maintained for two hours after which pressure is again released and a fillup check is made. Normally there is no fillup, all the plastic having been displaced behind the pipe. This procedure is continued until the squeeze reaches 1500 pounds standing pressure and there is some fillup of plastic in the casing. When this is accomplished the squeeze is complete and the plastic should be allowed to set for 24 hours before being drilled out.

Advantages of Plastic Squeeze

A tabulation of plastic squeeze jobs on casing shoes from January 1, 1947, to January 1, 1948, establishes the economy of this technique. Table I shows the average plastic squeeze job in Kansas cost $551.30. The most expensive job amounted to $977 and the least expensive cost the operator $245. To this should be added 48 hours cleanout time, from start of the plastic squeeze until the residual plastic is drilled out and the operator is ready to re-acidize. On the basis of $200 per day unit time for the cleanout job this would add $400 to the above cost and makes the average over-all cost of the squeeze job $951.30.

The largest quantity of plastic used on a shoe squeeze during the above period was 71 gallons; the smallest was seven and the average was 37.5 gallons. A satisfactory squeeze job was accomplished the first time on each job during 1947.

Plastic squeeze entails less waiting time before drilling out. The least time required to squeeze a casing shoe with plastic was nine hours. The longest time required was 36 hours and the average over-all time was 19.7 hours. To this should be added 24 hours setting time for the plastic to achieve its ultimate strength. At the end of this period the five to eight feet of plastic remaining in the casing can be drilled out at an average rate of four feet in a half-hour or less, while the Ottawa Sand used to protect the exposed pay can be sand pumped.

TABLE 1
Typical Casing Shoe Squeeze Jobs

COUNTY	Gallons of Plastic Used	Hours Required for Job	Cost	RESULTS
Rooks	65½	32	$803.50	Acidized and circulated shoe at approximate 600 lbs. Squeezed with cement. No good. Resqueezed with cement. Treated with Pilot and circulated shoe again with oil. Squeezed with plastic and treated with Pilot. Shoe held perfectly at 1350 lb. maximum pressure.
Russell	10	10½	245.00	Well history unknown. Apparently job was successful.
Russell	29	14	503.00	Well history unknown. Apparently job was successful. This was an old well.
McPherson	20	15	492.00	Water Loacting Survey run and shoe squeezed on the basis of survey. Apparently a good job. Acidized afterwards.
Rice	30	14	505.00	Ran Spinner Survey and squeezed shoe on basis of survey. Well did not make any fluid till after plastic was drilled out and and then made water. Abandoned.
Rooks	40	17	590.00	Acidized and circulated shoe at 650 lb. Squeezed with Plastic and retreated with Pilot. Shoe held perfectly at maximum pressure of 950 lb.
Ellis	71	36	977.00	Acidized and circulated shoe. Pressure unknown. Squeezed with cement. displacing ¼ barrel. Retreated with 750 gallons at 300 lb. Apparently circulated again. Ran Spinner. Squeezed shoe with Plastic and retreated down casing. Job successful.
Marion	21	9	322.00	Drilled out shoe and got water. Squeezed shoe and drilled deeper finally getting water again.
Russell	7	23	349.00	Cement channel when shoe was drilled out. Plastic squeeze success.
Rooks	40	10½	455.00	Acidized and circulated shoe at 800 lb. Squeezed with Plastic and retreated. Hole full of Arbuckle water. (By analysis).
Butler	25	23	510.00	Acidized and circulated shoe at 1200 lb. Squeezed with Plastic. Job successful.
Barton	49	21½	653.00	When plug drilled, blew tools up hole. Channel to gas sand supposedly cased off. Plastic squeeze on shoe eliminated gas.
Rooks	70	26½	835.00	Doubtful that it was a casing seat leak. Possibility conglomerate immediately beneath shoe.
Barton	66	21	722.00	Acidized and circulated shoe at 850 lb. Squeezed and treated with Pilot. Shoe held perfectly.
Barton	19	12	308.00	Acidized and circulated at 1075 lb. Cement squeeze at 2000 lb., no good. Resqueezed with Plastic. Treated with Pilot. Held perfectly.

Pressures not exceeding 1500 pounds have been found effective in squeeze casing shoes with plastic, a decided advantage at all times and especially when working with used pipe which is liable to damage under higher pressures necessary in other types of squeeze jobs.

Another important advantage is the permanence of a plastic squeeze, as it is not affected by sulfate water or sour crudes. Although the material sets as an impervious mass, when heated to 120° F it has a viscosity comparable to a light motor oil and thus has the ability to penetrate small crevices and form a highly impervious bond between the casing and the formation. The presence of oil in the hole has no effect in the setting and strength of plastic is equal to that of neat cement, yet it is easier to drill up. On occasions wells have been shot following a plastic squeeze with no evidence of fracture to the plastic.

Success of Plastic Squeeze Jobs

Several tests made during 1947 to determine the effectiveness of plastic squeeze showed the success of the technique, using the electric pilot to selectively acidize the pay section beneath the shoe. In this manner four wells were treated after the shoe had been squeezed with plastic and all held perfectly, there being no need to pump oil in the casing to control the acid-oil interface. Treating pressures ranged from 800 to 1350 pounds casinghead pressure. One well was successfully acidized down the casing after a plastic squeeze and definitely held in spite of the fact that acid was in direct contact with the shoe. In all other tests the wells, upon completion, indicated that the shoe was holding.

While all plastic squeeze jobs undertaken during 1947 were 100 percent successful, attention should be called as a matter of record to the fact that a plastic squeeze failure was reported in February, 1948. Cause of the failure has not definitely been determined, but unspent acid from a treatment a week earlier was bailed out of the hole after the attempted squeeze job. It is believed that the presence of hydrochloric acid caused a flash set of the plastic, making it set up in small balls instead of an impervious mass. When the recovered plastic was broken it was found to be porous.

Although plastic is comparatively new, it has established an enviable record of successful squeeze jobs and appears to offer distinct advantages as a technique to overcome, economically and quickly, the bottom hole water conditions frequently encountered in Kansas resulting from channeling at the casing shoe.

MEMO TO:

Johnston Formation Tester

OWNERS and OPERATORS

By unitizing a Johnston "SHOOT-N-TEST" Gun Perforator with your regular Johnston Formation Tester Assembly, any designated formation can be both perforated and tested in one round trip of tubing or drill pipe. The "SHOOT-N-TEST" Gun Perforator is easily connected to Johnston test equipment for combined Perforation and Test operations. Simple top-hole manipulation of the string by the driller prepares the Gun Perforator for firing -- existing hydrostatic pressure in the well trips the firing mechanism.

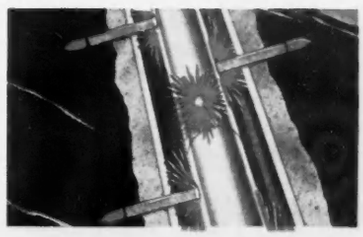
The Johnston "SHOOT-N-TEST" Gun Perforator has the versatility to be used solely as a casing perforator or as the perforating unit in combined perforation and test operations. Its design embodies many advanced features to make it the ideal choice for operators desiring the utmost safety and efficiency in perforation equipment.

THE JOHNSTON SHOOT-N-TEST GUN PERFORATOR

The Johnston "SHOOT-N-TEST" Gun Perforator connected to a regular Johnston Pressure Recorder and Formation Tester permits both casing perforation and formation test in a single trip of tubing or drill string.

"SHOOT-N-TEST" with the JOHNSTON All-Purpose GUN PERFORATOR Offers These Features

- SAFER GUN OPERATION
- POSITIVE FIRE OF ALL BULLETS
- ANY NUMBER OF PERFORATIONS
- EXACT POSITIONING in test zone
- MINIMUM NUMBER OF EXPENDABLE PARTS
- FAST, EASY MAINTENANCE



Fully patented—covered by Patent Nos. 2,073,107, 2,189,919, 2,126,641, 2,129,216, 1,901,813, 2,161,233, 2,176,766, 2,218,988, 2,186,488, 2,307,360, 2,305,139, 2,295,634

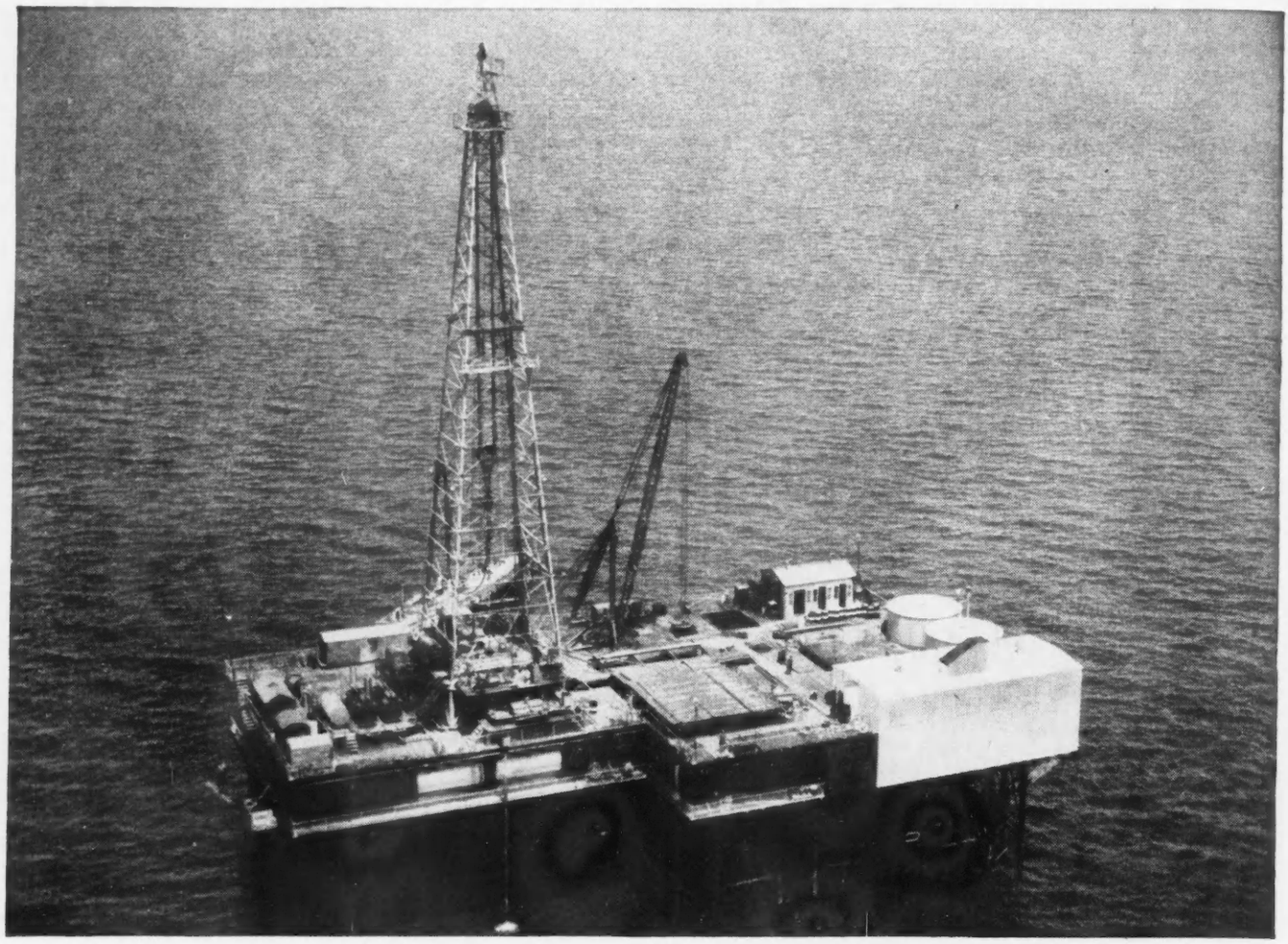
SHOOT-N-TEST Trademark FORMATION AND CASING TESTING

M. O. JOHNSTON OIL FIELD SERVICE CORP.
3035 Andrita Street, Los Angeles 41, California
"Servicing California-Permian Basin-Rocky Mountain Areas"

BRANCHES
BAKERSFIELD, CALIFORNIA • AVENAL, CALIFORNIA
SACRAMENTO, CALIFORNIA • VENTURA, CALIFORNIA
SANTA MARIA, CALIFORNIA • ODESSA, TEXAS • CASPER, WYOMING • HOBBS, NEW MEXICO

JOHNSTON OIL FIELD SERVICE CORP.
5702 Navigation Boulevard, Houston, Texas
"Servicing Mid-Continent and Gulf Coast Areas"

BRANCHES
ALICE, TEXAS • VICTORIA, TEXAS • WICHITA FALLS, TEXAS
GRAHAM, TEXAS • TYLER, TEXAS • FERRIDAY, LOUISIANA
LAKE CHARLES, LOUISIANA • SHREVEPORT, LOUISIANA
LAUREL, MISSISSIPPI • MAGNOLIA, ARKANSAS
CHICKASHA, OKLAHOMA



Oil from the sea through the magic of rubber

7 types of Hewitt Hose help sustain underwater project

You're looking at a platform eight miles out in the Gulf of Mexico.

Men drill for oil there. And they use seven different kinds of Hewitt Hose!

They use oil-resistant Hewitt Hose to feed their Diesel engines. They pump washing and cleaning water through Hewitt Hose that resists pumping pressures and salt water corrosion. To "acidize" the hole, they use special Hewitt acid-resistant hose.

And in the drilling operation, of course, they use Hewitt Rotary Drilling Hose and Hewitt Oil Suction and Discharge Hose. They know these two hoses have to have peak resistance to the abuses of drilling mud and oil.

Two more kinds of Hewitt Hose supply water for cooking and dish-washing, and for drinking.

These Hewitt Hoses work 24 hours a day under constant abuse from sun and sea for the men who get *oil from the sea through the magic of rubber!*

Petroleum men have specified Hewitt Hose for years. They know they can depend on it—no matter what the job or how severe the conditions.

Whatever your hose needs may be, you can depend on Hewitt-Robins. See your distributor or write to the Hewitt Rubber Division, 240 Kensington Avenue, Buffalo 5, N. Y.

HEWITT

Hose for the Oil Industry

HEWITT RUBBER DIVISION
INDUSTRIAL HOSE • BELTING • PACKING

Hewitt offers the oil industry a complete line of special hoses

For oil drilling:

Rotary Drilling Hose
Flexible Vibration Hose
Mud Pump Suction Hose

For oil refining:

Oil Suction and Discharge Hose
Sea Loading Hose
Barge Loading Hose
Fire Hose
Flue Cleaning Hose
Steam Hose

For oil distributing:

Tank Car Hose
Tank Truck Hose
Fuel Oil and Distillate Hose
Gasoline Pump Hose

also Propane-Butane Hose for all types of service

HEWITT-ROBINS HR **INCORPORATED**

Application of Secondary Recovery Methods

By J. P. WIBLE
Gulf Oil Corporation, Tulsa

EVALUATION OF three prime considerations in determining the application of secondary recovery methods to a field, zone or sand is shown by the author in this discussion to give basic data upon which can be predicated the time and location of flooding operations. Failure to consider these factors, on the other hand, may result in loss of much valuable production.

FOR the purposes of this paper the term "secondary recovery" is limited to secondary operations in depleted or partially depleted reservoirs, as distinguished from pressure maintenance operations in areas of flush production, sometimes also classed as a secondary recovery.

Since the initial step in the consideration of any field or property for the application of secondary recovery methods is to decide whether conditions appear favorable, it might be well first to review the criteria for determining the possibilities of profitably applying secondary recovery methods. Much has been written on this subject. The API's bulletin on "Secondary Recovery of Oil in the U. S." contains a schedule listing about 100 items of information considered desirable for a thorough study of the secondary recovery possibilities of an oil pool. Field history, petroleum geology, core data, reservoir characteristics, production data, development and operating practices, water and gas supply, and economic consideration are some of the main divisions of this outline. All of the items, however, point to three main considerations: (1) the volume of residual oil in the reservoir; (2) the characteristics of the producing sand bearing on how much of this oil can be recovered by secondary methods; and (3) the economic considerations.

The latter includes not only a study of costs and market conditions, but also whether more is to be gained by individual operations or by a pooling of interests in a unitized or cooperative project. How exhaustive the investigation need be will depend, of course, upon how much is at stake in the success or failure of the project, but the basic criteria are the same, whether for a "dump" flood involving only a few marginal wells or for a large pool.

The residual oil saturation is usually estimated either directly from the oil content of cores or by volumetric calculations involving factors of sand thickness, pore volume, connate water content, shrinkage, and accumulated production or by a combination of both methods. In depleted pools where oil is not seriously flushed from the cores by expanding gas, good results are being had in the Mid-Continent area by analysis of cable tool cores. This method of coring is now being used by all companies operating repressuring projects in the Glenn pool of Oklahoma. Core recovery averages better than 95 percent and biscuits are large enough for test plugs, hence a good permeability profile is obtained. Casing is set at the top of the sand to exclude all water before coring is started. Starch mud is used to minimize flushing by drilling fluid. Cores obtained by this method show oil saturations as high as 60 percent, indicating little flushing.

Core data have also been found invaluable in the Glenn pool in determining the actual thickness and location of the pay section (Figure 1). Over much of this pool the sand is about 150 feet thick and no great difference in the character of the sand from top to bottom could be determined from old well logs. However, core data have revealed that over most of the pool the bottom 50 feet of the sand is of non-pay character because of low permeability, low oil saturation, and high water content. Also, because of depletion and possible gravity drainage, the oil content in the top 30 to 40 feet of sand is too low for profitable secondary recovery operations. Actual thickness of good oil pay, therefore, is only 40 to 60 feet. Obviously, estimates of secondary recovery performance based upon total sand thickness would have been far out of line.

Unfortunately, in most preliminary investigations of old pools core data are not available; also, in projects of a minor nature involving only the conversion of old wells for water injection, it may not be economical to drill core tests. In such cases in estimating residual oil content it is necessary to rely upon available information from old well logs and upon production data. If it can be determined that the recovery mechanism has been solely the gas-drive type, it is usually assumed that the residual oil content will be high, since primary recovery by this mechanism seldom exceeds 15 to 20 percent of the pore volume. If estimates are made on this basis allowance must be made for shrinkage and for the possibility that oil may have been thiefed into any gas cap area that may have existed when the pool was originally drilled. A factor difficult to estimate without core or electric log data is the percent of connate water in the sand. This is very important, since it has a bearing both upon the volume of residual oil and the degree of channeling that might be expected through zones of high water content. There is some evidence that where connate water exceeds 40 percent of the pore volume, gas drive may give better results than water-flood.

If it can be determined that water production is from the bottom part of the sand, and if vertical permeability is low, it may be possible to exclude the water zone and flood successfully the remainder of the sand. However, at one such test in the Bartlesville sand in Osage County, Oklahoma, where the sand is 80 feet or more thick, it was found from cores and tests while drilling that water had fingered in through permeable streaks to within 25 feet of the top of the sand. Water injected into the cored well quickly channeled through to the nearby producer with no increase in oil. The possibility of high water content in the sand, either as intersti-

tial water originally present or through slow infiltration of edge or bottom water throughout the life of old pools, should be given very careful study in investigating water flood possibilities.

The second main consideration is an analysis of the geological features of the reservoir, both with respect to structure and to the characteristics of the reservoir rock. In many small reservoirs of the stratigraphic trap type the structural relief is moderate and structure may have no noticeable effect upon secondary operations. However, on well-defined anticlinal structures, or where appreciable monoclinal dip exists, it is considered better practice to introduce gas at up-dip locations and water down dip. Consideration of structure is important where the edge or flank drive type of water flood is planned.

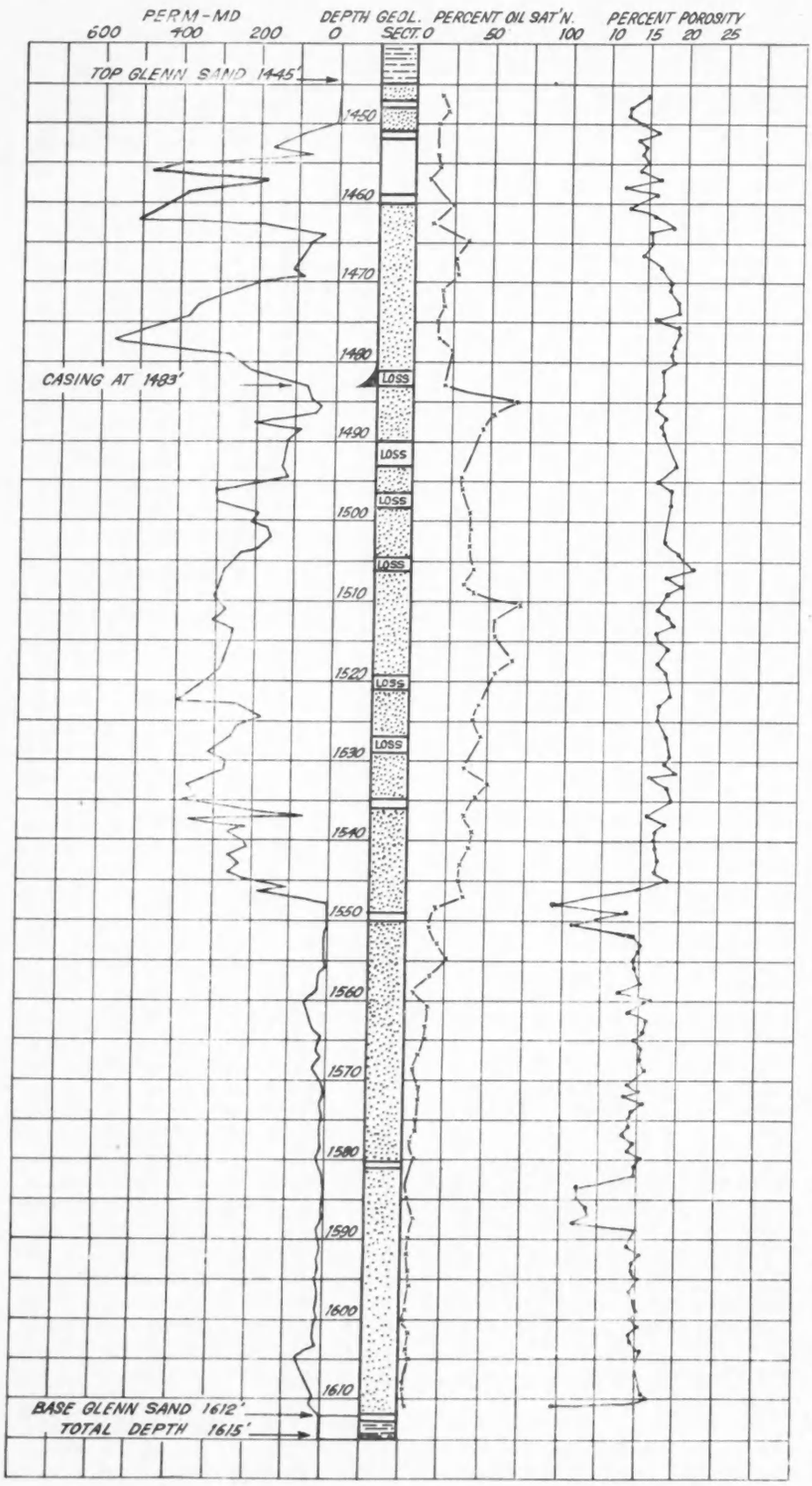


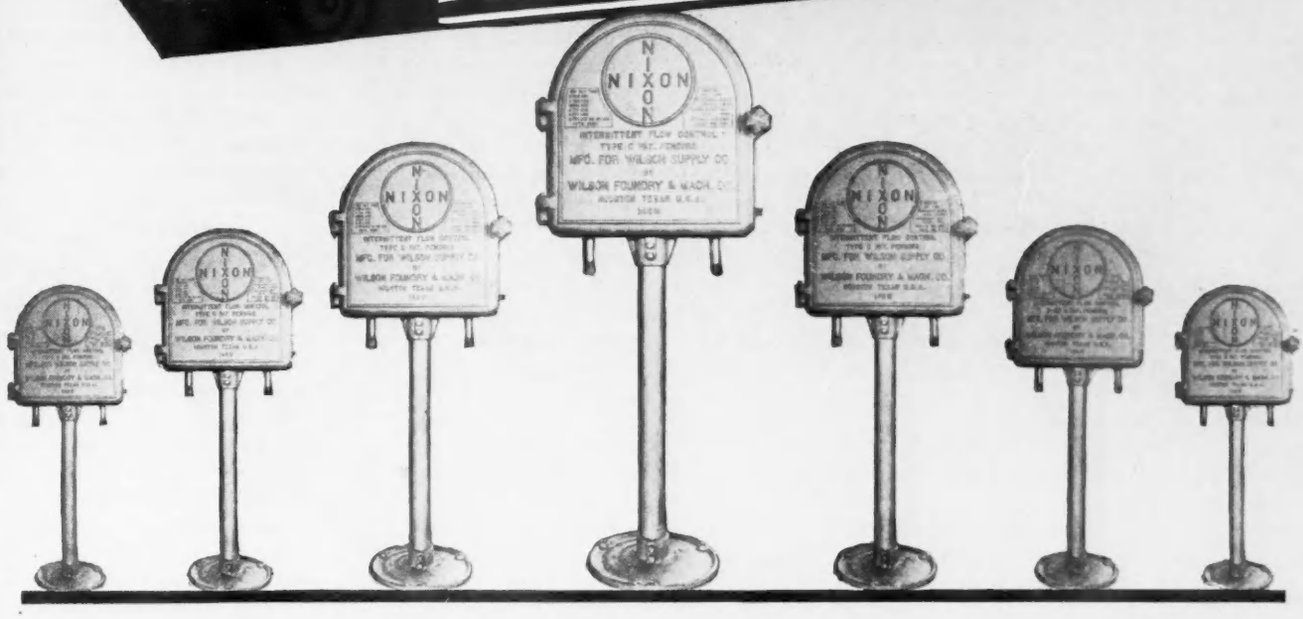
FIGURE 1. Core Analysis, Glenn pool, Creek County, Oklahoma

Such factors as variations in porosity and permeability, thickness and continuity of shale layers, the presence of thin partings in the sand which would restrict vertical permeability, or clay materials in the sand which might swell upon contact with water and reduce permeability, are geological features requiring careful investigation. These factors are important in estimating the degree of bypassing and channeling to be expected and have a direct bearing on the selection of an input pattern which will minimize losses due to trapped oil.

Lateral continuity of sand members in lenticular reservoirs is particularly important. A pilot flood test on a lease in Glenn pool furnishes a good example of the importance of geological interpretation of sand conditions. A core test in the center of the tract encountered 61 feet of Glenn sand. The top 24 feet had good oil saturation and permeability, but the remainder was tight sand and shale with low oil content. The well was plugged back and water injected into the upper 24 feet of sand. Formation tops from old well logs in the vicinity indicated the beds were dipping to the northeast. However, a subsequent geological study of the Glenn formation disclosed that the apparent dip was due to a pinchout of the upper members of the sand body, and that the good pay section of the sand at the input well probably was not present in the oil wells to the north and east. This conclusion was confirmed by the performance of the water flood which has benefited wells to the south and west of the input well but has had no effect upon wells to the north and east. Approximately one-half of the tract flooded had no chance to benefit from water injected into this upper member of the sand.

The economic factors which control the feasibility or applying secondary recovery methods are much the same as those which control primary operations. When the enormous cost of exploratory development in the search for new primary oil reserves is considered, the outlay necessary for an adequate pilot plant to confirm or disprove existence of substantial secondary reserves becomes less impressive. However, there is no point in recovering additional oil unless it can be produced at a profit; therefore, secondary development and operations must be carefully planned in

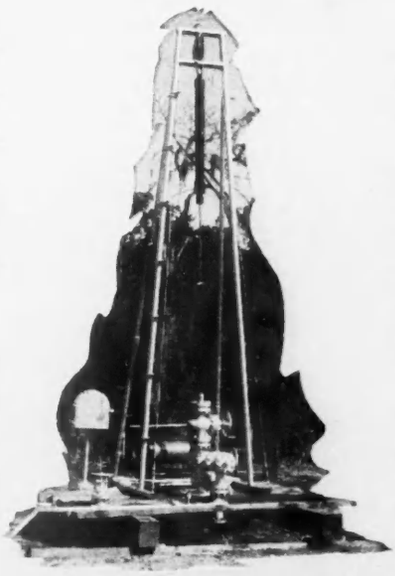
For those Low Fluid Level Wells use the NIXON Surface Control GAS LIFT



Economical . . . Certain In Operation

The Nixon Surface Control "Low Fluid Level" Gas Lift Unit will produce small wells more efficiently than any other type of gas-lift equipment. This statement has been proven in hundreds of wells located in the West Texas area.

The volumetric capacity of the "Low Fluid Level" Unit ranges from 200 barrels per day down to less than one barrel. The operating depth of this type installation covers wells from a few hundred feet in depth to those below 7500 feet.



When equipped with Nixon "Low Fluid Level" Units your wells produce their fluid only against flow line pressure, as all high pressure gas is confined above the tubing packer. Pulling jobs are few and far between, because "sand" will not cut-out this equipment.

More than 3500 of these Units are now in the field, with many in continuous operation for 5 years or more without the tube having been pulled.

Contact your nearest Wilson Supply Store or write:
Gas Lift Department, Wilson Supply Company, Drawer 19, Houston, Texas

WILSON SUPPLY COMPANY

1412 MAURY ST., HOUSTON, TEXAS

SALES OFFICES: Tulsa, Oklahoma; Dallas, Texas.
SANTA FE SPRINGS, CALIF: Atlas Production, Inc.
1126 Lakeland Road

BRANCH STORES: TEXAS—Kilgore, Beaumont, Barbers Hill, Bay City, Monahans, Alice, Victoria, Corpus Christi, Columbus. LOUISIANA—Lake Charles, New Iberia, Harvey, Shreveport, Houma. ARKANSAS—Magnolia.

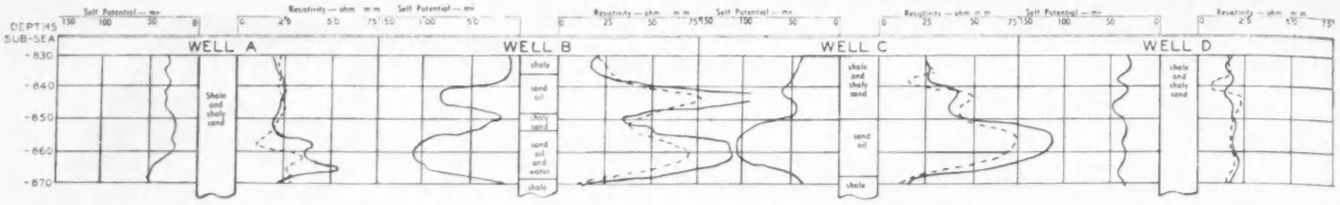


FIGURE 2. Cross-section of electric log data showing lenticularity of sand in a pool in Union County, Kentucky.

relation to costs and probable recovery. Such factors as spacing pattern, the conversion of producers to inputs instead of drilling new wells, flowing versus pumping, and the time required to complete the flood under different operating methods should be considered in their relation to anticipated costs and revenue.

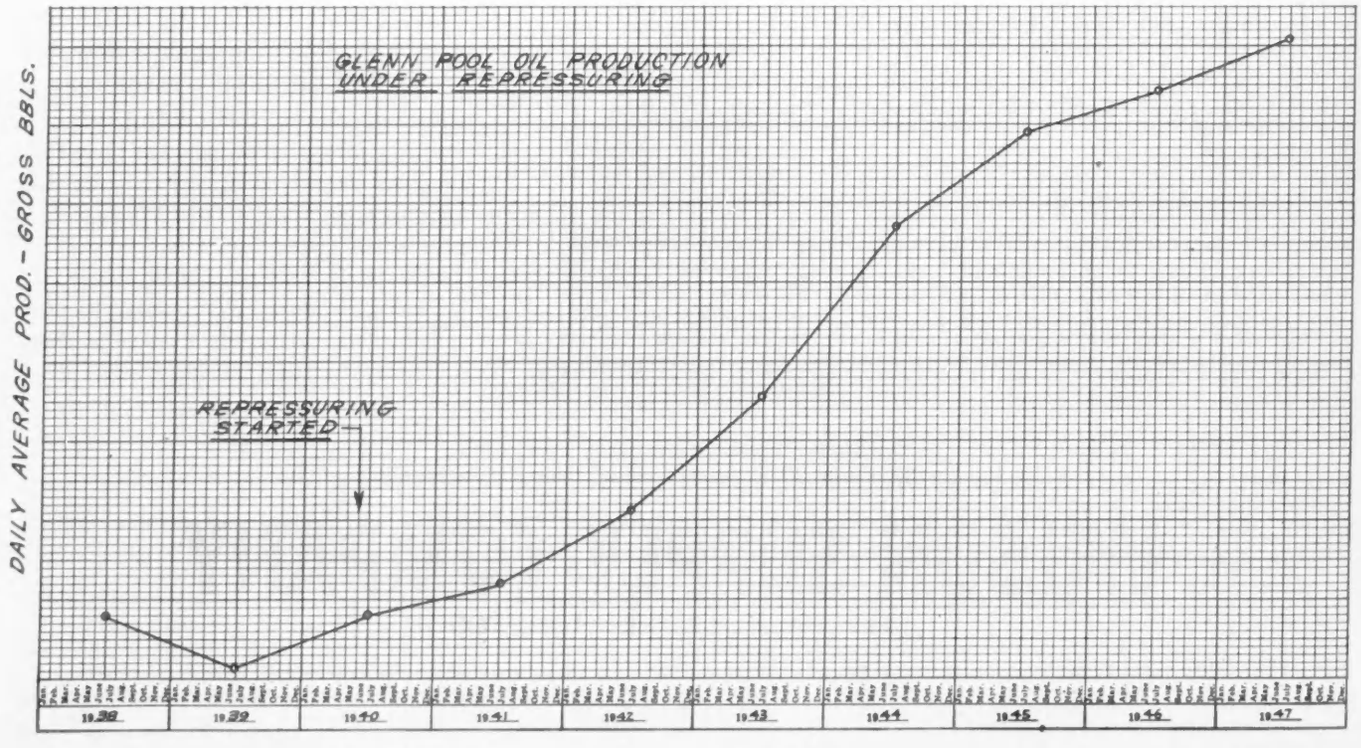
The possibility of having to re-equip producers to handle increased volumes of fluid should not be overlooked. In the deeper pools in the Mid-Continent area wider spacing up to 20-acre and 40-acre patterns and means of converting producers for injection purposes are being given a great deal of consideration. Where old wells have been utilized as inputs it has been found good practice to seal off any open hole between the casing seat and the top of the oil sand in order to prevent channeling of water along bedding planes in these exposed sections. Also where casing has not been cemented at the top of the sand it is advisable to cement the pipe to prevent circulation around the shoe into shallower formations. Concerning water supply and plant operations, the present trend is to inject brine when available at reasonable cost. The use of brine lessens the hazard of reducing permeability due to clay materials swelling in the sand. Also, brine is being successfully used in closed and semi-closed systems at some projects without the expense of treating and filtering.

An important economic consideration in secondary recovery is at what stage of primary depletion secondary operations should be started. It is becoming generally recognized that where pressure maintenance is feasible it should be started as soon as possible. However, in gas expansion type reservoirs, where the sand body is not homogeneous, there is the hazard of trapping a large part of the primary reserve if water is injected before the bulk of the recovery to be had by gas expansion is effected. An example of this type of reservoir is the Mansfield sand on a property recently developed in Kentucky. Because this lease is located in the flood-lands of the Ohio River and operating costs are unusually high, the possibilities of shortening the producing life by applying secondary recovery were investigated. The Mansfield sand is lenticular, grading into shaly sand and shale on all sides of the small reservoir (Figure 2). Also, a shale break separates the sand into two zones over much of the pool. Thin partings reduce the vertical permeability to practically zero; hence, the injected water would spread laterally only through the section of sand exposed in the input wells. At the present stage of depletion it appeared impossible to flood this sand without trapping off a substantial volume of oil that could be recovered by primary methods, unless a very close input pattern was used. In this case it seemed advisable to defer flooding the sand until primary reserves were further depleted.

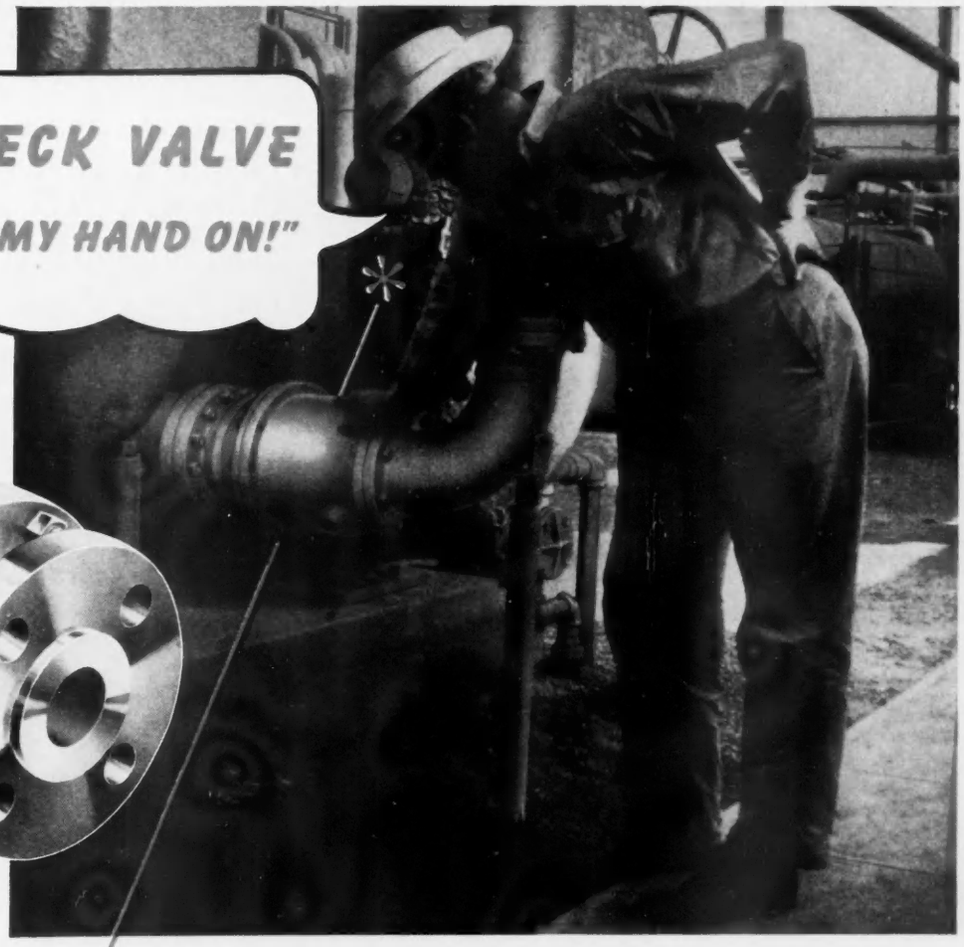
A drawback to the more widespread application of water flooding in the deeper sands in the Mid-Continent fields has been the price of crude oil in comparison to high investment and operating costs required to exploit these formations. Improved market conditions and the high cost of developing new primary reserves no doubt will stimulate flooding activity. While the cost of obtaining data on reservoir conditions and carrying out adequate pilot flood tests in the deeper formations will be high, the much greater financial risk involved increases the importance and need of a thorough analysis of the reservoir before applying secondary recovery methods.

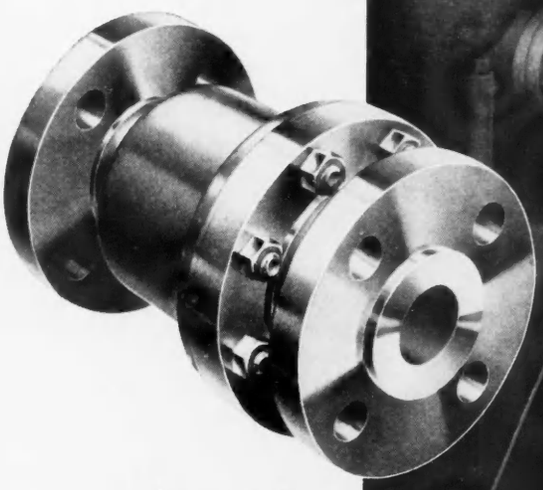
ACKNOWLEDGMENT

The author wishes to thank Gulf Oil Corporation for permission to publish this paper, which is based on the Secondary Recovery proceedings, Technical Program, Production Engineering Conference of the Gulf Oil Corporation held in Pittsburgh, Penn.

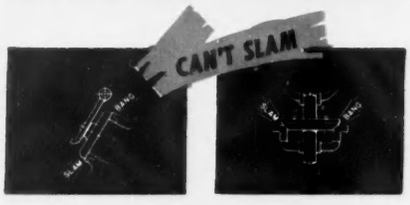


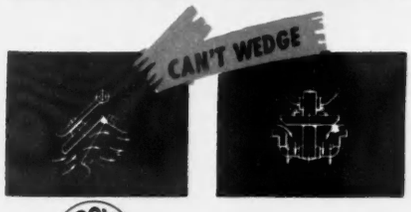
"BEST CHECK VALVE I EVER LAID MY HAND ON!"





So says the Head Shift Operator of La Gloria Corporation at Falfurrias, Texas





NEVER FAILS TO OPEN OR CLOSE

Grove CHEXFLO Check Valves are doing their job with unfailing dependability. That is why more and more operators are installing them. After all, what's the use of using a check if you can't depend on its working when it is most needed. In this particular installation, illustrated above, Grove 6″ 150# steel CHEXFLO is employed on a centrifugal compressor handling isobutane vapor at 80 p.s.i. and 120° F.

When you want to end check valve troubles, install Grove CHEXFLOS. Get full facts today. Wire, write for Bulletin 610B.

GROVE SIMPLICITY ACCURACY SAFETY

GROVE CHEXFLO CHECK VALVES

"Put Pressure to Work"

GROVE REGULATOR CO. 6529 HOLLIS STREET . OAKLAND 8, CALIF.

Factory Branches: 3608 Navigation Blvd., Houston, Texas • 1930 W. Olympic Blvd., Los Angeles 6, California

Oil Production by Gas and Flooding

Part 3

By PARK J. JONES
Consultant, Houston

Vaporization in Oil Reservoirs

VAPORIZATION is estimated by applying K values differentially in the pressure range for which K values are reliable. Vaporization transfers only a nominal volume of oil from a reservoir liquid to a reservoir gas.

The Rayleigh Equation

Given a reservoir liquid having the composition $\Sigma Z_i = 1$ at a given pressure and temperature. A decline in reservoir pressure is accompanied by vaporization. Denote the composition of the remaining reservoir liquid at some declined pressure by $\Sigma X_i = 1$. The reservoir pressure at any time is the bubble-point pressure for the remaining reservoir liquid.

At the initial pressure, a differential quantity dZ_1 of methane gas is in equilibrium with the moles of methane $(Z_1 - dZ_1)$ in a reservoir liquid. Accordingly,

$$\frac{dZ_1}{Z_1 - dZ_1} = K_1 \qquad (1)$$

where K_1 is the equilibrium constant for methane at the initial pressure. A similar equation holds for the ith component. Thus,

$$\frac{dZ_i}{Z_i - dZ_i} = K_i \qquad (2)$$

The ratio K_i/K_1 is called relative volatility and is denoted by A_i. Hence,

$$A_i = \frac{K_i}{K_1} = \frac{dZ_i}{Z_i - dZ_i} \cdot \frac{Z_1 - dZ_1}{dZ_1} \qquad (3)$$

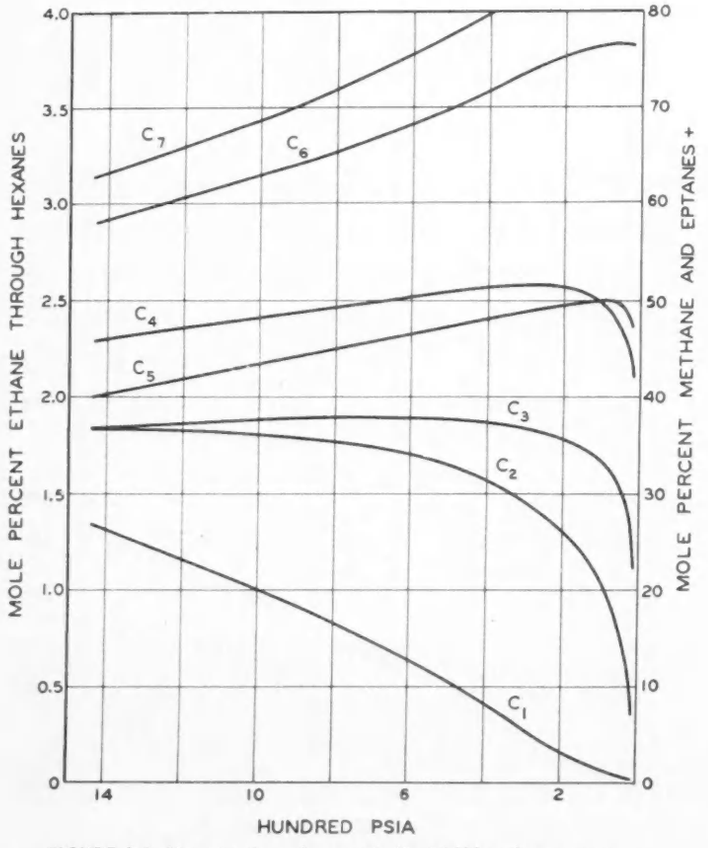


FIGURE 3-1. Vaporization of reservoir liquid 'A' at low pressure.

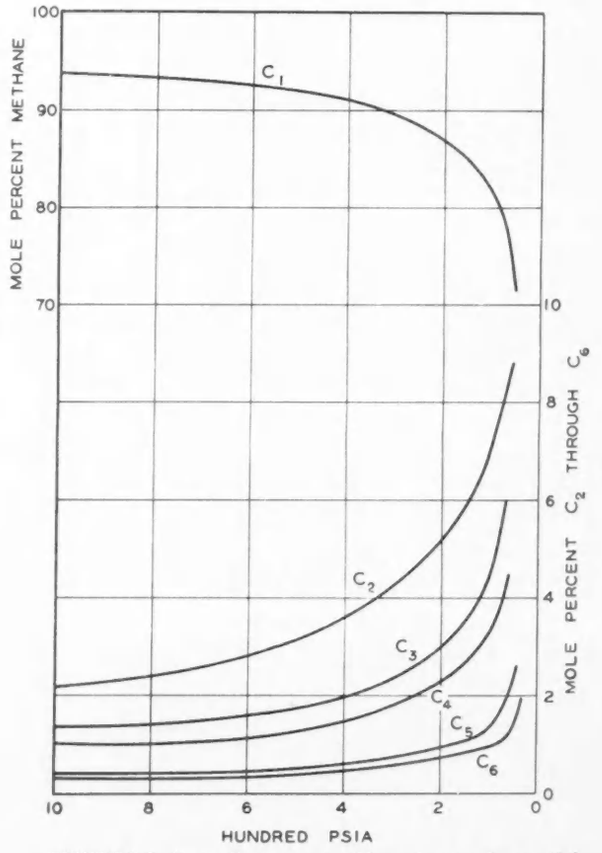


FIGURE 3-2. Approximate composition of reservoir gas 'A.'

CRALL SPIRAL PARAFFIN SCRAPERS

(Pat. Reg. U. S. Pat. Off.)

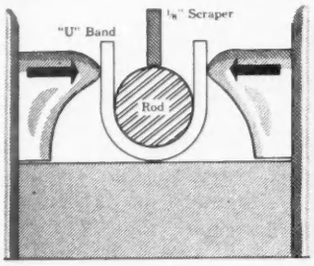
ELIMINATE PARAFFIN ACCUMULATION

The New More Economical Way

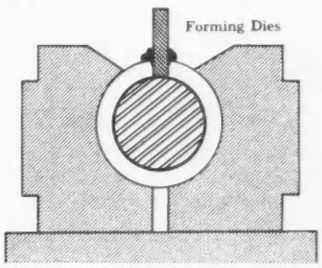
. . . in the tubing of PUMPING WELLS

This illustration shows how scrapers securely attach to rod. Rod string does not rotate. Scrapers also act as rod guide.

CRALL Spiral Paraffin Scrapers fit any sucker rod. When scrapers are placed on the reciprocating rod at specified distances, they meet or pass each other with each reciprocation. The complete coverage and churning action in the tubing column of oil prevents the accumulation of paraffin. CRALL Scrapers are now used by scores of major and independent oil-producing companies.



Cross section showing "U" band being die-formed around rod to within a fraction of an inch of scraper blades.



Cross section showing band held under pressure around rod while ends of band are shrink-grip attached to scraper blade.

The "U" bands are placed on the rod in a special die jig and formed the remaining distance around the sucker rod to within a fraction of an inch of the scraper blade. The sucker rod with scraper in place, is then passed on to the special air pressure die jig and the bands are held under pressure around the rod while the ends are being shrink-grip-attached to the scraper blade. This effects an extra strong 360-degree FRICTION grip on the scraper to the rod without impairing in any way, the properties of the material in the sucker rod. NEITHER SCRAPERS NOR BANDS ARE WELDED TO THE SUCKER ROD.

The original installation is the ONLY cost. Order your CRALL Spiral Scrapered Rods from your Supply Store or phone, wire or write . . .

Look at these Features:

1. Saves work-over, passing scrapers and eliminates STRIPPING JOBS.
2. Scrapers average six ounces each, making extra load to string negligible.
3. Scrapers alternate—one right, the next left, eliminating tendency of the rod to unscrew . . . a balanced rod string.
4. No work at well. Give us size tubing, number of scrapers per rod or length stroke of pump.
5. No gadgets to fool with. No maintenance costs. Pay for themselves in saving down time.
6. Tests in actual operation show CRALL Scrapers still performing perfectly after months and months in use.

CONSTRUCTION:

CRALL Spiral Scrapers are made of ⅛" thick mild steel, approximately 6" long. The width of the scraper blade varies to give you 1¾" O. D. coverage in 2" tubing, and 2¼" O. D. coverage in 2½" tubing, regardless of size of sucker rod used. Perfect fit is guaranteed, and there is no stress on the metal. The ⅛" x 1" preformed "U" bands to hold the scraper rigidly in place (one at each end of scraper) are made of mild strap steel. This scraper will not slip on the Sucker Rod.

PETROLEUM SPECIALTY CO.
P. O. BOX 1640, PAMPA, TEXAS
Manufacturing and Fabricating Plants at Pampa and Levelland, Texas.

TABLE 3-1

Vaporization from 1440 to 1000 Psia of Reservoir Liquid "A"

	FZ_i	k_i*	A_i	Log FZ_i/LX_i	FZ_i/LX_i	LX_i	K_i†	KLX_i	X_i
C_1	26.41	4.0	1.0	0.16643	1.467	18.00	4.7	84.60	19.78
C_2	1.83	1.5	0.375	0.06241	1.115	1.64	1.6	2.62	1.80
C_3	1.83	0.74	0.185	0.03079	1.073	1.71	0.79	1.35	1.88
IC_4	1.07	0.51	0.128	0.02122	1.050	1.02	0.53	0.54	1.12
NC_4	1.22	0.41	0.103	0.01706	1.040	1.17	0.43	0.50	1.28
IC_5	0.92	0.24	0.060	0.00999	1.023	0.90	0.24	0.22	0.99
NC_5	1.07	0.21	0.053	0.00874	1.020	1.05	0.21	0.22	1.15
C_6	2.90	0.12	0.030	0.00499	1.011	2.87	0.11	0.32	3.15
C_{7+}	62.75	0.0082	0.002	0.00033	1.001	62.69	0.0075	0.47	68.85
	100.00	....	....	.....	.....	91.05	....	90.84	100.00

* At 220° F. and 1200 psia. † At 1000 psia.

TABLE 3-2

Vaporization from 1000 Psia to 400 Psia of Reservoir Liquid "A"

	FZ_i	k_i*	A_i	Log FZ_i/LX_i	FZ_i/LX_i	LX_i	K_i†	KLX_i	X_i
C_1	18.00	6.3	1.00	0.45591	2.857	6.30	11.0	69.30	8.05
C_2	1.64	2.0	0.317	0.14452	1.395	1.18	3.0	3.54	1.51
C_3	1.71	0.96	0.152	0.06930	1.173	1.46	1.4	2.04	1.87
IC_4	1.02	0.60	0.095	0.04331	1.105	0.92	0.83	0.76	1.18
NC_4	1.17	0.48	0.076	0.03465	1.083	1.08	0.67	0.72	1.38
IC_5	0.90	0.26	0.041	0.01869	1.044	0.86	0.34	0.29	1.10
NC_5	1.05	0.22	0.035	0.01596	1.037	1.01	0.29	0.29	1.29
C_6	2.87	0.12	0.019	0.00866	1.020	2.81	0.15	0.42	3.59
C_{7+}	62.69	0.0074	0.0012	0.00055	1.0013	62.61	0.0089	0.56	80.03
	91.05	....	.....	.....	.....	78.23	.....	77.92	100.00

* At 700 psia. † At 400 psia.

TABLE 3-3

Vaporization from 400 to 100 Psia of Reservoir Liquid "A"

	FZ_i	k_i*	A_i	Log FZ_i/LX_i	FZ_i/LX_i	LX_i	K_i†	KLX_i	X_i
C_1	6.30	17	1.00	0.73119	5.385	1.17	42	49.14	1.62
C_2	1.18	4.6	0.271	0.19815	1.578	0.75	11	8.25	1.04
C_3	1.46	2.1	0.124	0.09067	1.232	1.19	4.7	5.59	1.65
IC_4	0.92	1.2	0.071	0.05191	1.127	0.82	2.5	2.05	1.14
NC_4	1.08	0.95	0.056	0.04095	1.099	0.98	2.1	2.06	1.36
IC_5	0.86	0.49	0.029	0.02120	1.050	0.82	1.1	0.90	1.14
NC_5	1.01	0.42	0.025	0.01828	1.043	0.97	0.93	0.90	1.35
C_6	2.81	0.20	0.012	0.00877	1.020	2.75	0.43	1.18	3.82
C_{7+}	62.61	0.012	0.0007	0.00051	1.001	62.55	0.024	1.50	86.88
	78.23	....	.....	.....	....	72.00	.....	71.57	100.00

* At 250 psia. † At 100 psia.

TABLE 3-4

Vaporization from 100 to 20 Psia of Reservoir Liquid "A"

	FZ_i	k_i*	A_i	Log FZ_i/LX_i	FZ_i/LX_i	LX_i	K_i†	KLX_i	X_i
C_1	1.17	69	1.00	1.76716	58.50	0.02	217	4.34	0.03
C_2	0.75	19	0.275	0.48597	3.062	0.24	57	13.68	0.35
C_3	1.19	7.6	0.110	0.19439	1.565	0.76	23	17.48	1.10
IC_4	0.82	3.9	0.0565	0.09984	1.258	0.65	11	7.15	0.94
NC_4	0.98	3.3	0.0478	0.08447	1.215	0.81	9.3	7.53	1.17
IC_5	0.82	1.7	0.0246	0.04347	1.105	0.74	4.8	3.55	1.07
NC_5	0.97	1.5	0.0217	0.03835	1.092	0.89	4.2	3.74	1.29
C_6	2.75	0.69	0.0100	0.01767	1.042	2.64	1.9	5.02	3.82
C_{7+}	62.55	0.038	0.00055	0.00097	1.002	62.43	0.11	6.87	90.23
	72.00	....	.....	.....	.....	69.18	.....	69.36	100.00

* At 60 psia. † At 20 psia.

TABLE 3-5

Approximate Molal Composition of Reservoir Gas "A"

Psia	1000		400		100		20	
	VY	Y	VY	Y	VY	Y	VY	Y
C_1	8.41	93.97	11.70	91.27	5.13	82.35	1.15	40.78
C_2	0.19	2.12	0.46	3.59	0.43	6.90	0.51	18.08
C_3	0.12	1.34	0.25	1.95	0.27	4.33	0.43	15.25
IC_4	0.05	0.56	0.10	0.78	0.10	1.61	0.17	6.03
NC_4	0.05	0.56	0.09	0.70	0.10	1.61	0.17	6.03
IC_5	0.02	0.22	0.04	0.31	0.04	0.64	0.08	2.84
NC_5	0.02	0.22	0.04	0.31	0.04	0.64	0.08	2.84
C_6	0.03	0.34	0.06	0.47	0.06	0.96	0.11	3.90
C_{7+}	0.06	0.67	0.08	0.62	0.06	0.96	0.12	4.25
	8.95	100.00	12.82	100.00	6.23	100.00	2.82	100.00

Neglect differentials of higher order and obtain

$$\frac{dZ_i}{Z_i} = A_i \frac{dZ_1}{Z_1} \qquad (4)$$

This is a differential form of the Rayleigh[3] equation for differential vaporization of a liquid. Now, in the region of low pressures, the variation of the relative volatility for the ith component is approximately linear. Let k_i be the K value for the ith component at the average vaporization pressure and let k_1 be the corresponding value for methane. Then k_i/k_1 is a constant and equation (4) may be integrated. For FZ_i initial moles and LX_i final moles, we have

$$\int_{LX_i}^{FZ_i} \frac{dZ_i}{Z_i} = \frac{k_i}{k_1} \int_{LX_1}^{FZ_1} \frac{dZ_1}{Z_1}$$

from which

$$\log \frac{FZ_i}{LX_i} = A_i \log \frac{FZ_1}{LX_1} \qquad (5)$$

Equation (5) is solved by assuming the moles of methane in a liquid at the end of a vaporization. The correct value of LX_1 is the value for which $\Sigma LKX_i = L$ where K is the ith component equilibrium constant at the final vaporization pressure. The molal composition of the liquid at the end of a vaporization is defined by $\Sigma X_i = 1$ where X_i is obtained by dividing moles of the ith component in the remaining liquid by the moles of the liquid.

Vaporization from 1440 to 1000 Psia

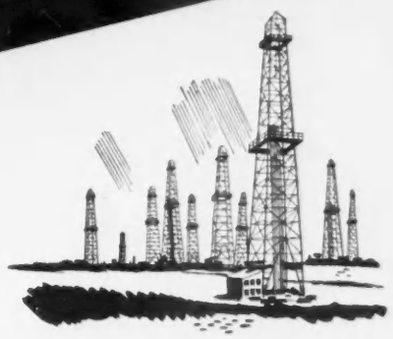
The FZ column in Table 3-1 shows the moles by components in 100 moles of a reservoir liquid at 1440 pounds per square inch absolute and 220° F. We wish to find the composition of the remaining reservoir liquid when reservoir pressure is 1000 psia. The k_i column shows the K values for 220° F. and 1200 psia. The A_i column shows the relative volatility. Assume there are 18 moles per 26.41 moles of methane remaining at 1000 psia. This gives 1.467 for the initial to final methane ratio. The common logarithm of the methane ratio is 0.16643. The latter value multiplied by the relative volatility gives the logarithm of the initial to final ratio for the other components. The LX column shows the moles for each component in the reservoir liquid at 1000 psia provided the methane ratio is 18/26.41. In order to test this assumption, multiply the LX values by their respective K values at 1000 psia. The sum of the KLX values is 90.84 which is near enough to 91.05 for illustrative purposes. The LX_i values divided by 91.05 give the molal composition shown in the last column.

The 91.05 moles of the bubble-point liquid at 1000 psia was vaporized differ-

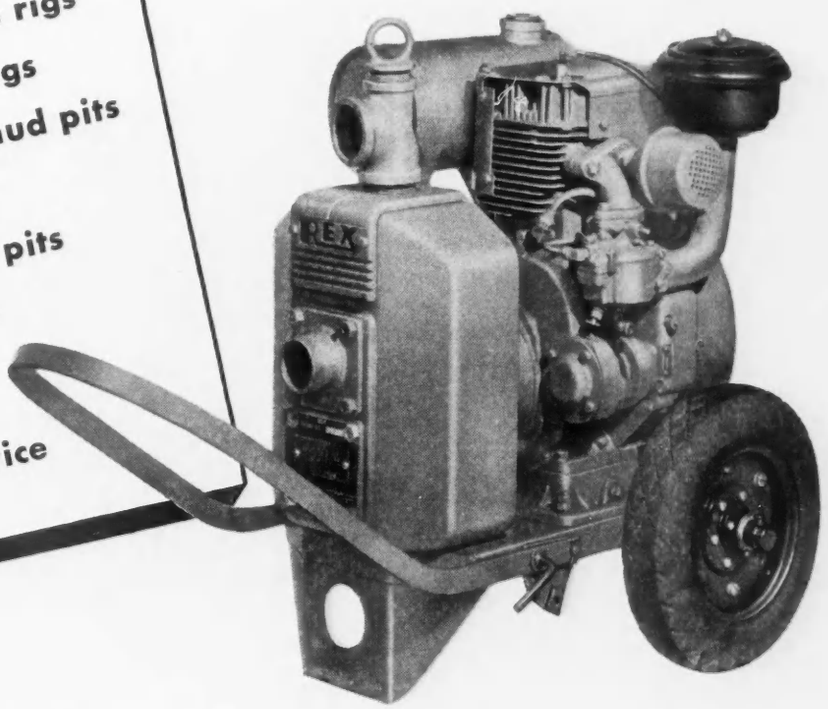
■ CONTINUED ON PAGE 156

THERE'S A NEW LITTLE YELLOW PUMP —

Around the Rigs!



- Pumping water to the rigs
- Washing down the rigs
- Jetting water into mud pits
- Draining ditches
- Pumping out slush pits
- Transferring slush from pit to pit
- General dewatering service



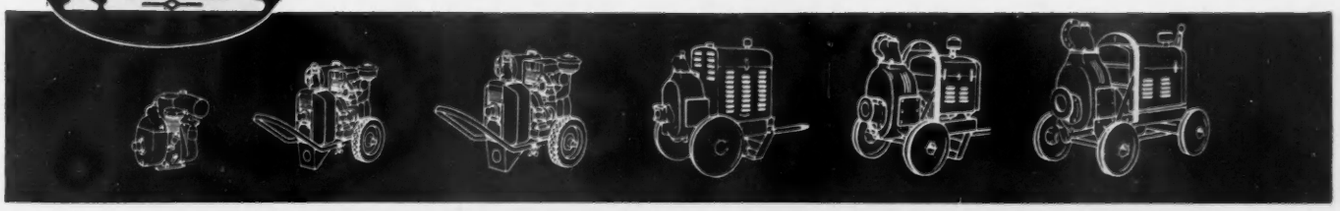
The *new* little yellow Rex Pump is the ideal unit for all-round utility service. Because of the press-formed body, it is light in weight and easy to handle.

This new Rex Pump is amazingly durable. It's built to take a lot of punishment, to give you years of dependable, trouble-free pumping performance. If damages should occur, body can be easily repaired by welding.

The smooth surfaces of the press-formed pump body speed the flow of water through the pump. It's the fastest self-priming, most efficient pump in the field today.

There's no limit to the useful tasks this pump can do. Check with your Rex Field Engineer, your local supply store, or write direct to Chain Belt Company, 1639 West Bruce Street, Milwaukee 4, Wis.

REX **OIL FIELD PUMPS**



CHAIN BELT COMPANY *of* MILWAUKEE

OXYGEN CONCENTRATION EFFECT

On Flood Water Iron Pickup

By HOWARD A. STOLTENBERG
University of Kansas, Lawrence, Kansas

LABORATORY STUDIES should precede use of water for flooding operations, with especial care shown the effect of the chosen fluid on metal of the pipe used in the circuit. The author describes tests to determine the effect of dissolved oxygen; tests which showed that iron pickup was proportional to oxygen content down to about two parts per million, at which point corrosion becomes extremely slight.

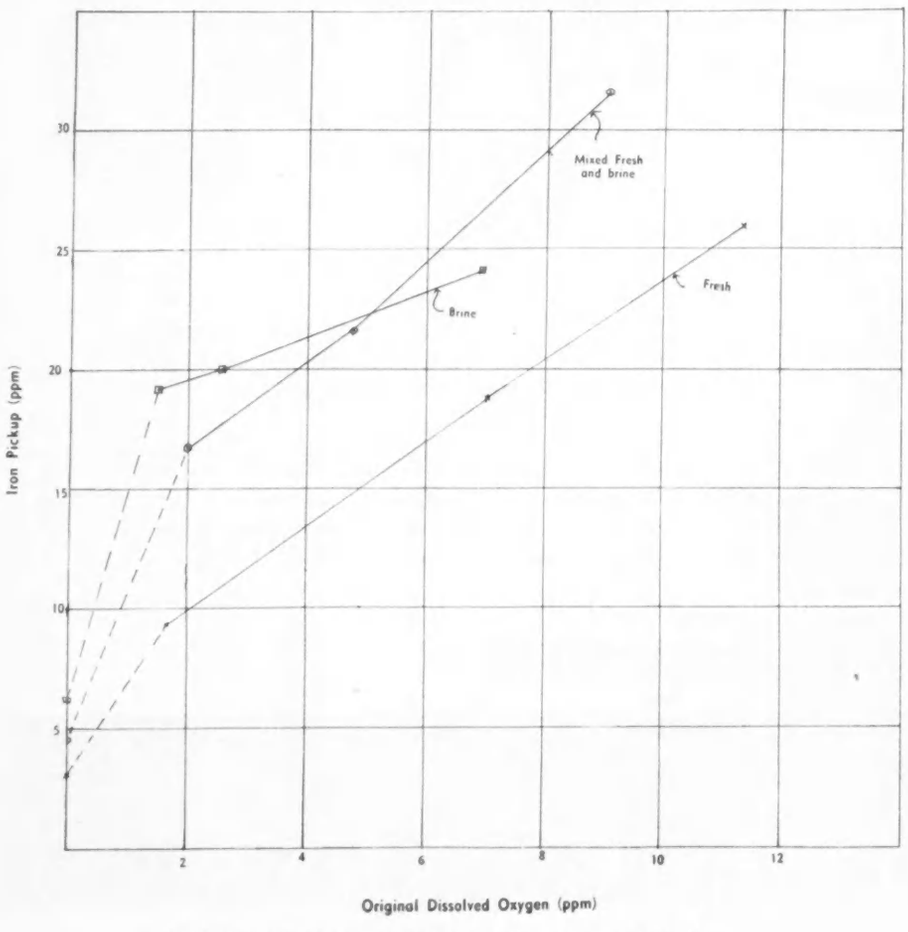


FIGURE 1. Corrosive action of selected waters on steel plate.

IN THE recovery of oil by the process of water-flooding oil sands, one of the chief causes of expense and trouble is the corrosion of pipe lines and equipment. In addition, there is considerable evidence that the products of corrosion are carried into the input wells to become imbedded on the face of the sand, and thus obstruct the passage of water into the sand.

Probably the principal cause of corrosion of this nature is the dissolved oxygen carried by the injection water. Certain operators are now removing most of the oxygen from the water by means of mechanical deaeration, in the belief that by so doing their corrosion difficulties will be greatly decreased.

The tests covered in this report were undertaken in order to determine the extent to which partial and complete removal of dissolved oxygen reduced the corrosiveness of three waters as measured by the amount of iron picked up by the water on standing in contact with pieces of steel.

The three waters under examination may be identified as: (1) fresh; (2) mixed fresh and return water from oil wells; and (3) brine (Arbuckle).

The principal method used in the determination of dissolved oxygen in the various samples was the Alsterberg or sodium azide modification of the Winkler method. For the samples containing sulfites and those judged to be high in ferrous iron the method used was the alkaline-hypochlorite modification of the Winkler method.

The method used for iron determination in all cases was the colorimetric thiocyanate method for total iron.

Five samples were set up for each water . . . three with varying quantities of dissolved oxygen, and two treated with sodium sulfite to chemically remove the last traces of oxygen. The dissolved oxygen content of each water was measured when set up and this condition was labeled the raw state. The other two oxygen values for the fresh and the mixed waters were obtained by mechanical deaeration with a laboratory type vacuum pump. For the brine it was found necessary to aerate the water.

The iron contents of the three original waters were negligible.

Small strips of steel plate were cleaned

NUMBER 1 OF A SERIES PRESENTING:

Pacific's Proved Performance

in years of uninterrupted service!

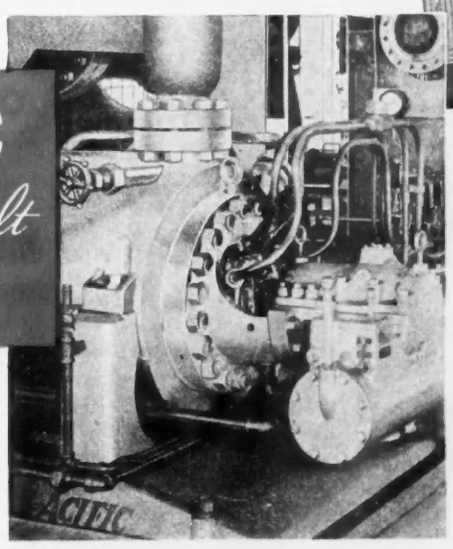
In January 1938 Wilshire Oil Company installed a 4-inch, 8-stage PACIFIC PUMP, Type ITB, Serial Number 4445. Following good practice, this pump was thoroughly inspected and checked in January 1939 and then returned to service.

Look at the Log:

From January 1939 to March 1948 this PACIFIC PUMP was on stream a total of 62,789 hours...delivered 31,000,000 bbls. of 600°F. oil against a discharge pressure of 800 p.s.i.g. THAT'S PACIFIC DEPENDABILITY!

During this same period the stuffing boxes were repacked 5 times and, in April 1946 one new shaft sleeve was installed...PACIFIC PUMP maintenance cost from January 1939 to March 1948 was only .0164¢ per 1000 lbs. of oil pumped. THAT'S PACIFIC ECONOMY!

Because this PACIFIC PUMP had not been opened for inspection during its many years of continuous service, it was deemed advisable to check the interior clearances and replace parts if necessary. The check was made during the March turn-around and the pump returned to service to continue its outstanding performance record. THAT'S PACIFIC SERVICE!



PACIFIC *Precision Built* PUMPS

PACIFIC PUMPS INC.
Huntington Park, California
One of the Dresser Industries
Export Office:
Channin Building, 122 East 42nd Street, New York
Offices in All Principal Cities

PR-4

carefully with a file and wiped to remove the small pieces of loosened iron and scale. One strip was placed in each of fifteen 300 ml. bottles before the water was introduced. Calculated quantities of sodium sulfite were weighed in the dry state and placed in the bottles also before the introduction of the water under test.

In all cases the water was introduced into the bottles by means of a siphon. The ground glass stopper was then placed in the bottle so that no air bubbles were trapped. The bottles were allowed to stand at room temperature in an inverted position, the stopper and neck of the bottle being submerged under water. Once each day the contents of each bottle were thoroughly agitated.

At the end of three weeks the bottles were unstoppered and dissolved oxygen and iron determined on each sample. The iron value includes that in suspension as well as that in solution.

Results of these tests are tabulated below:

Sample 1 (Fresh Water)

pH original water = 7.2
Total alkalinity (as $CaCO_3$) = 125 ppm.
Free CO_2 = 15 ppm.

CONDITION	Original Dissolved Oxygen	Three Weeks Dissolved Oxygen	Three Weeks Iron
Raw	11.35 ppm.	0.0 ppm.	26 ppm.
Partly deaerated	7.00	0.0	18
Deaerated	1.50	0.0	9.1
Sulfite—10	0.0	0.0	2.7
Sulfite—15	0.0	0.0	3.2

The "Sulfite-10" and "Sulfite-15" indicate that sodium sulfite was added in the ratio of 10 ppm of Na_2SO_3 to 1 ppm of O_2 and 15 ppm of Na_2SO_3 to 1 ppm of O_2.

Sample 2 (Mixed fresh water and return water from oil wells)

pH original water = 7.4
Total alkalinity (as $CaCO_3$) = 229 ppm.
Free CO_2 = 18 ppm.

CONDITION	Original Dissolved Oxygen	Three Weeks Dissolved Oxygen	Three Weeks Iron
Raw	9.15 ppm.	0.0 ppm.	32. ppm.
Partly deaerated	4.60	0.0	22.
Deaerated	2.00	0.0	17.
Sulfite—10	0.0	0.0	4.2
Sulfite—15	0.0	0.0	4.9

Sample 3 (Arbuckle Brine)

pH original water = 7.8
Total alkalinity (as $CaCO_3$) = 82 ppm.
Free CO_2 = 2 ppm.

CONDITION	Original Dissolved Oxygen	Three Weeks Dissolved Oxygen	Three Weeks Iron
Fully aerated	6.90 ppm.	0.0 ppm.	24. ppm.
Partly aerated	2.60	0.0	20.
Raw	1.60	0.0	19.
Sulfite—10	0.0	0.0	6.1
Sulfite—15	0.0	0.0	6.1

In all three waters tested, corrosion is severe at high oxygen contents. Iron pickup falls with decreasing oxygen concentrations and drops sharply when all oxygen is removed. The mixed water and the Arbuckle water with their higher salt contents show greater iron pickup at all oxygen concentrations than the fresh water. The Arbuckle brine shows less difference in iron pickup at varying oxygen concentrations than either the fresh or mixed water.

In all three waters the amount of iron picked up is proportional to the amount of dissolved oxygen present down to an oxygen content of about two parts per million. Apparently further decrease in oxygen concentration results in a much more rapid decrease in iron pickup. It seems, therefore, that for mechanical deaeration to be most effective in reducing corrosion, the installation must be capable of reducing the oxygen content well below three ppm. While some corrosion occurred even in the absence of oxygen it was much less severe.

The results of these tests are expressed graphically in Figure 1.

The high dissolved oxygen content of the raw fresh and raw mixed waters will approximate field conditions in cold weather. These samples, at room temperature, were supersaturated with oxygen. After standing awhile, a bubble formed in each of the "raw condition" sample bottles. By agitating, however, the oxygen was redissolved as the corrosion reduced the dissolved oxygen below saturation. Eventually all was used up as evidenced by the zero dissolved oxygen of these samples at the end of the test.

ACKNOWLEDGMENT

The author wishes to express his thanks to the officers of the Brundred Oil Corporation for their helpful suggestions and criticisms, and for permission to publish this article.

About the Author

HOWARD A. STOLTENBERG received an M.A. degree in chemistry from the University of Kansas in 1938. After serving as assistant instructor in chemistry at the University of Kansas for two years he joined Sinclair Prairie Oil Company at Tulsa. In 1941 he became chief chemist of the Division of Sanitation, Kansas State Board of Health. He holds that position and in addition is an instructor in chemistry at the University of Kansas.

Oil Production by Gas and Flooding

■ CONTINUED FROM PAGE 152

entially to 400 psia in Table 3-2. There are 78.23 moles of liquid having the composition shown in the last column.

The 78.23 moles were vaporized differentially to 100 psia in Table 3-3. There are 72.00 moles of reservoir liquid. The latter was vaporized to 20 psia in Table 3-4. There are 69.36 moles of 20-pound liquid per 100 moles of 1440-pound liquid.

The compositions shown in Tables 3-1 through 3-4 are plotted in Figure 3-1. Methane and ethane content decreases throughout the pressure range. The propane content increases slightly to about 600 psia and then decreases. The butanes content increases to about 300 psia and then decreases. The pentanes content increases to about 100 psia. The hexanes content increases to about 50 psia. As only two points were calculated for pressures less than 400 psia, the data are intended as qualitative rather than quantitative illustrations on differential vaporization in reservoirs.

The butanes plus content at 1440 psia was 69.93 moles per 100 moles of reservoir liquid. At 20-psia reservoir pressure, the butanes plus content is 68.16. The transfer from liquid to gas was 1.67 moles of butanes plus per 100 moles of 1440-pound liquid. If the 1.67 moles were oil, the molal recovery aside from displacement would be about 2.4 percent. But the volumetric recovery would be less than one percent even if butanes plus were oil. Therefore, oil recovery by vaporization is here practically negligible. In other words, such oil as is recovered by evolved solution gas is produced by virtue of liquid displacement by gas rather than by vaporization.

Composition of Gas 'A'

The difference between the initial and final moles of a reservoir liquid gives the moles of gas vaporized. Table 3-5 shows the approximate composition for the gas vaporized from liquid 'A.' The data are also plotted in Figure 3-2. As only two points were calculated below 400 psia, the data are not quantitatively exact. Figure 3-2 is intended only as a qualitative illustration of the variation in the composition of a gas at low pressures in oil reservoirs. At low enough pressures, the butanes plus GPM of an evolved gas is very high. But, as already noted, the liquid volume represented by vaporized butanes plus may be only one percent of the liquid volume represented by the butanes plus initially in a reservoir. Consequently, oil recovery depends predominantly on produced gas-oil ratios.

REFERENCES

[1] Dodson and Standing, API, 1941.
[2] Katz, D. L., The Oil Weekly, Nov. 30, 1942.
[3] Standing, M. B., The Oil and Gas Journal, May 17, 1947.

Baash-Ross News

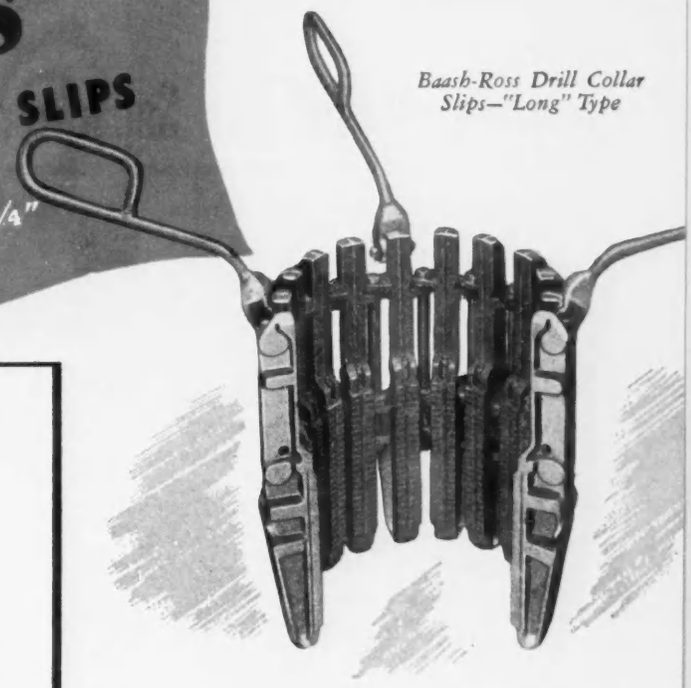
BAASH-ROSS TOOL COMPANY · LOS ANGELES · HOUSTON · NEW YORK

OUR 28th YEAR

4 HAZARDS

MAKE BAASH-ROSS DRILL COLLAR SLIPS "MUST" SAFETY PROTECTION

. . . And Every Drill Collar from 3" to 8¼" can have this vital protection!



Baash-Ross Drill Collar Slips—"Long" Type

FOUR HAZARDS make supporting a drill collar in the rotary table one of the riskiest of all rig operations . . .

. . . 1 *The constant change of drill collar diameter caused by wear and abrasion against the fresh-cut walls of the hole.*

. . . 2 *The usual flush design with no shoulders for stopping a slipping drill collar.*

. . . 3 *The drill collar's hard heat-treated surface that reduces gripping efficiency.*

and 4 *The relatively low drill string weight available for wedging the slips into the bowl.*

That's why safety-minded operators throughout the world have adopted Baash-Ross Drill Collar Slips as "must have" rig equipment, because these Slips are *specially designed* to overcome the risks of supporting a drill string in the rotary table. In contrast to the normal fixed-curvature design of rotary slips, the unique multi-segment design of Baash-Ross Drill Collar Slips permits them to w-r-a-p around the drill collar like a chain tong. They take a full slip-proof grip whether the drill collar is new or worn, round or out-of-round. *And they automatically compensate for as much as 1½" change in drill collar diameter — more than ample for modern drilling operations.*

For example, note in the table how a Baash-Ross Drill Collar Slip that fits a 7" diameter drill collar will also fit *any* diameter down to 5½". Adjustment for wear is automatic and continuous throughout the working range!

This means that Baash-Ross Drill Collar Slips automatically take a *full* grip on any drill collar within their range—a grip that gives adequate support to compensate for the continuous wear which changes drill collar diameters . . . for the hard heat-treated surface . . . and for the lack of drill string weight.

Sizes and Operating Ranges of Baash-Ross Drill Collar Slips

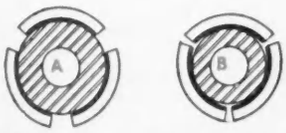
SIZE*	Operating Range	
	From	To
A	3"	4½"
B	3¾"	5¼"
C	4¼"	5¾"
D	5½"	7"
E	6¾"	8¼"

*(all sizes available in both "Regular" and "Long" types)

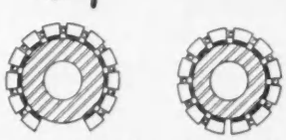
TWO TYPES

Baash-Ross Drill Collar Slips are available in two types —"Regular" and "Long." The "Long" type has extensions above the gripping area to provide a seat for the Baash-Ross Safety Clamp — the clamp that puts a non-slip, *yet removable*, "stop shoulder" on *any* drill collar to compensate for the hazards of flush design when supporting the collar in the table. For complete details see your nearest Baash-Ross representative — or write direct!

The "why" of Baash-Ross Drill Collar Slips



ORDINARY SLIPS that fit the drill collar when new (A) are unable to adjust themselves to smaller diameters as the drill collar wears away. Result, grip becomes less and less adequate (B) and risk of a costly fishing job constantly greater.

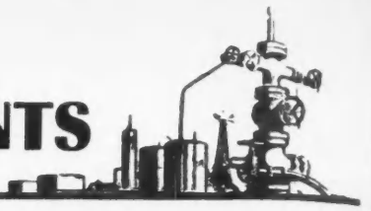


BAASH-ROSS DRILL COLLAR SLIPS consist of many narrow slip segments flexibly linked together. Result —they w-r-a-p around the drill collar and always take the same *full* grip whether drill collar is new or worn, round or out-of-round.

LINERS ARE EASILY RENEWED

To insure long life, minimum maintenance and maximum gripping efficiency at all times, the liners in Baash-Ross Drill Collar Slips can be readily renewed by simply pulling a stainless steel pin, sliding out the worn liner, inserting a new liner and replacing the pin. *It's simple, quick and inexpensive!*

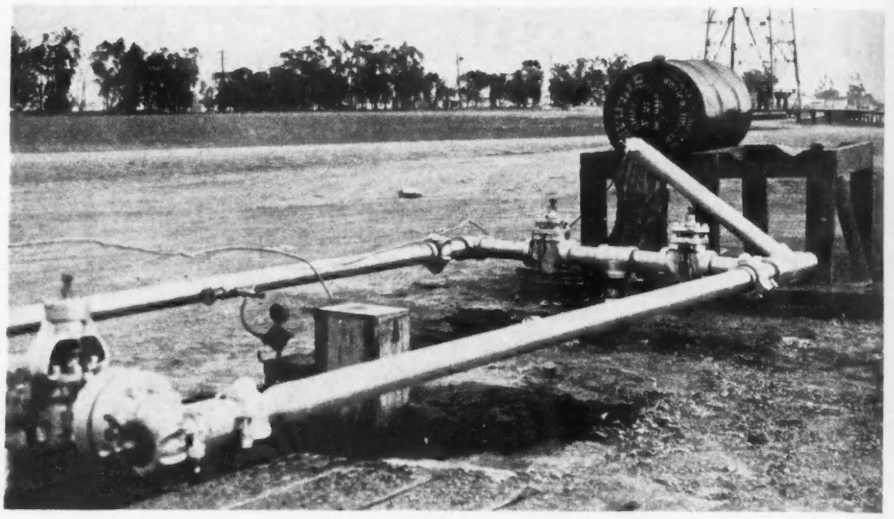
PRODUCTION HINTS



$10 is paid for each illustrated acceptable contribution. Mail to The Editor, WORLD OIL, P. O. Box 2608, Houston 1, Texas

HOW TO—Mount Gas Separator on Flow Line to Operate Motor

Instead of laying a gas pipe line from the oil and gas separator near the tank battery back to a flowing well to supply power to operate the motor of a chemical pump, gas can be taken from the manifold through a connection installed at one end of a flow line. At a point where one flow line turns to connect with the one on the opposite side to meet a flow line leading to the conventional oil and gas separator, a tee is installed in place of the usual ell. This tee is made up with the opposite end from the lead line closed with a bull plug.

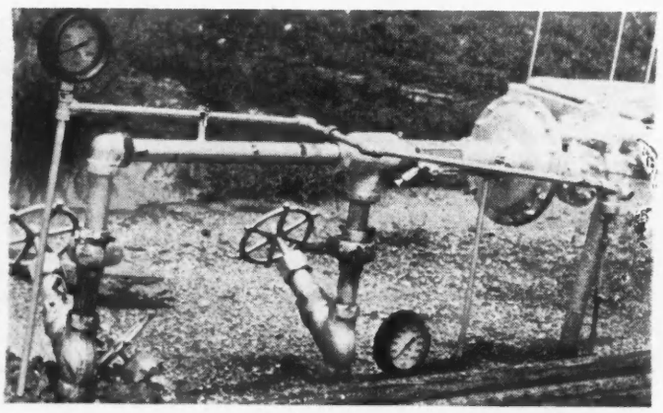


Into the side of the ell is screwed a short three-inch nipple closed with a flat or orange peel head. At the top end of this nipple there is a conventional one-eighth-inch pipe connection into which fittings are placed to attach copper tubing which conducts the gas from the nipple to the pump of the chemical feeder introducing fluid into the top of the Christmas tree to treat cut oil.

If the flowing pressure of the well is in excess of the usual 25 or 30 pounds required to operate the feeder motor, a standard reducing valve, similar to an oxygen reducer, is installed at the feeder to lower the gas pressure to that required. Any position from an angle of 45 degrees to vertical for the three-inch nipple serving as a separator is satisfactory on wells where this small separator is being used.

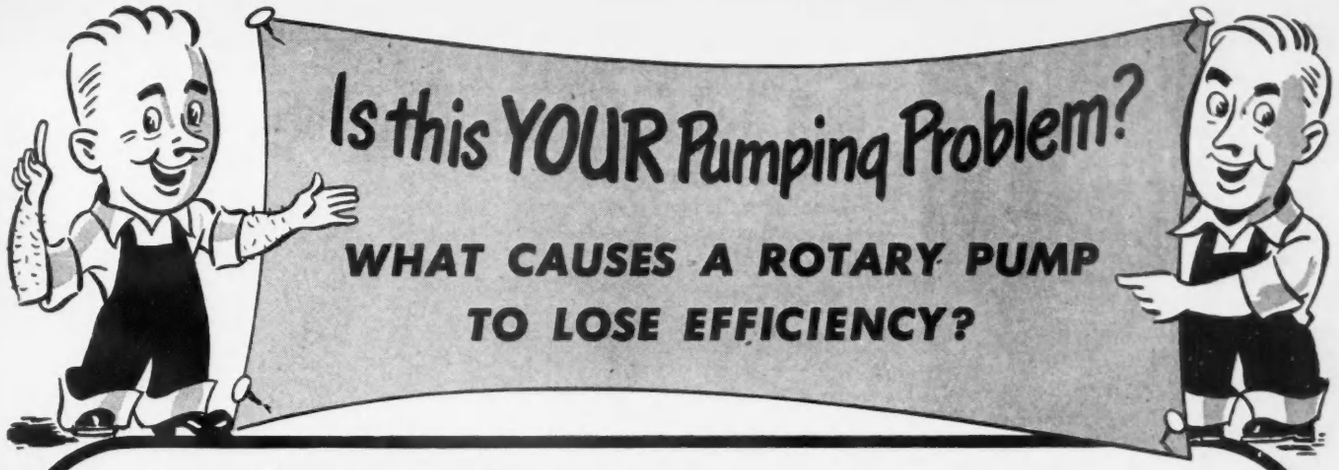
HOW TO—Make High-Pressure Regulator for Maintenance Ease

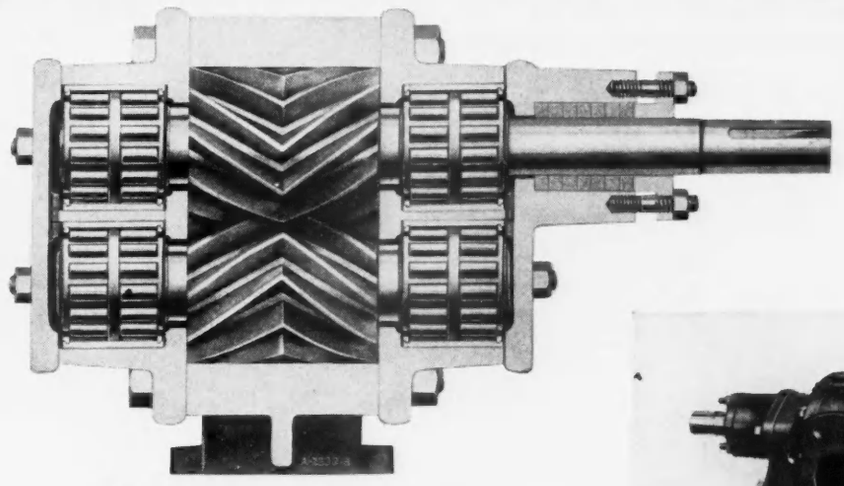
High-pressure regulation equipment must be kept at peak efficiency in order that maximum volumes of gas can be handled and adequate protection provided for other lease equipment. The installation shown reduces gas pressure to approximately 1200 pounds per square inch. Maximum safety was assured by burying the two-inch lines carrying the gas and exposing only the regulating equipment and by-pass connections.



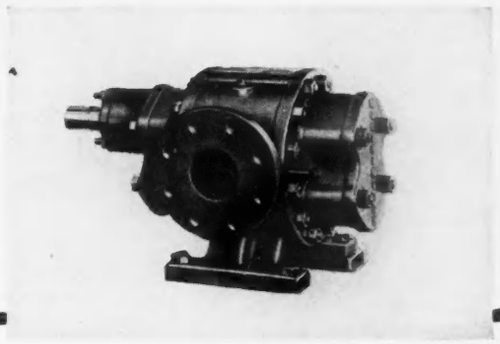
Two risers connected to the high-pressure gas line extend about 20 inches above ground level. Each riser contains a two-inch, heavy-duty valve for shutting in line pressure and removing the regulator assembly. A third valve is placed in the main line between the two riser connections to provide a means for manually regulating the flow of gas through the two-inch flow line when the regulator assembly is removed.

Two high-pressure unions and supporting uprights provide the convenience in servicing the complete unit. The support is merely a section of pipe driven into the ground to support the weight of the regulator assembly, thereby removing this load from the regulator body. In the event repairs are necessary on the regulator assembly, the two valves can be closed, while the third valve whose handle is barely exposed above ground is opened. The assembly can be removed and a similar one put in its place. The flow of gas can again be put through the regulator while the former assembly is taken to the shop for repairs.





Only Worthington GR Rotary Pumps have these four large roller bearings that aid in keeping capacity losses to a minimum.



THE heart of a rotary pump is its bearings, and any loss of pumping efficiency is usually traceable to "heart trouble". That's because power requirements, load-balance, self-lubrication and length of service life are all directly affected by the bearings' ability to keep the rotor shafts properly aligned so as to maintain close clearance in the rotor gears. The slightest bearing wear or shaft misalignment widens this clearance, resulting in increased capacity loss and decreased efficiency.

In Worthington GR Rotary Pumps four big roller bearings — two on each side of the load — assure steady alignment, less danger of wear in the vital rotor gears, minimum capacity loss and longer life. This is the "strong heart" — *a Worthington exclusive* — that keeps GR's pumping efficiently year after year, with only normal periodic servicing.

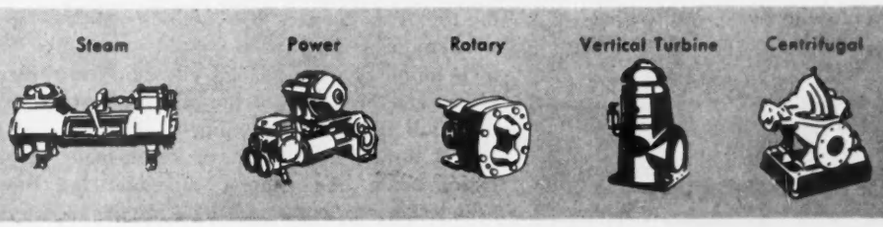
In Oil Fields The World Over

Worthington Rotary Pumps are giving daily proof of unequalled dependability and economy. One reason is that, like every other Worthington Pump, they're built *right* in every detail for the jobs they must do. For Bulletins with further facts proving *there's more worth in Worthington* write to *Worthington Pump and Machinery Corporation, Reciprocating Pump Division, Harrison, N. J.*

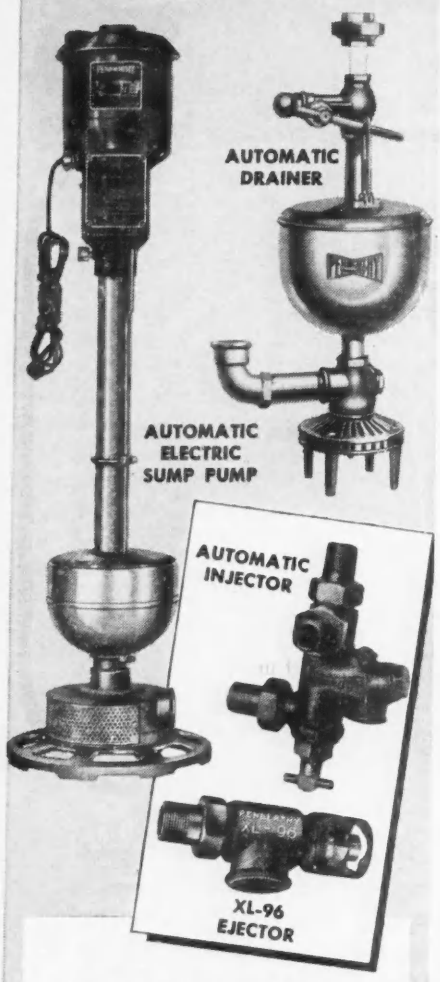
WORTHINGTON

PB-8

THE WORLD'S BROADEST LINE ASSURES YOU THE RIGHT PUMP FOR EVERY JOB



PENBERTHY
Quality Products



Penberthy Automatic Electric Sump Pumps and Penberthy Automatic Drainers (water or steam operated) have demonstrated their superiority wherever seepage water accumulates. Simple rugged design—copper and bronze construction throughout.

Penberthy Automatic Injectors assure an uninterrupted supply of feed water to oil field boilers at minimum cost. Reliable under most severe operating conditions.

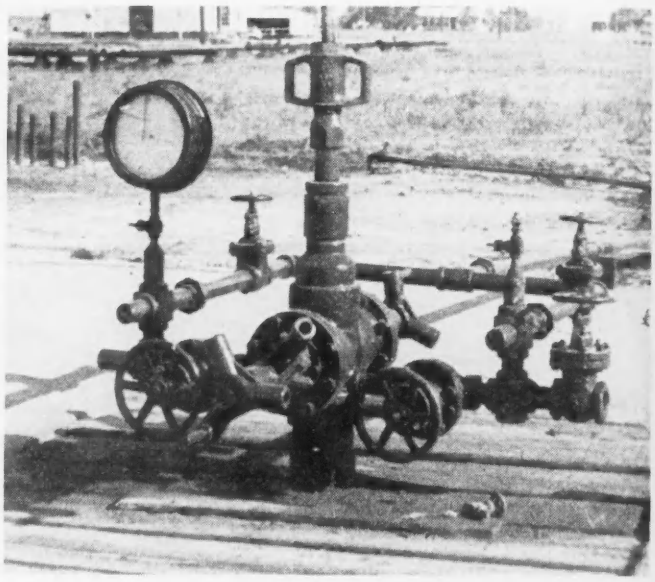
Penberthy Ejectors use the power of steam, air or water under pressure to lift liquids. No moving parts—no lubrication. Also used as water heaters.

3277-A

PENBERTHY INJECTOR CO.
Detroit 2, Mich.
Canadian Plant—Windsor, Ontario

HOW TO—

Learn Well Conditions When Put on Pump

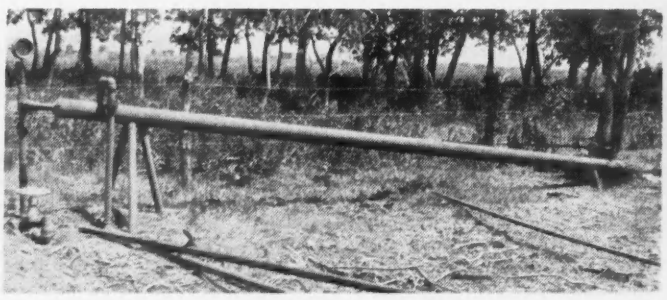


When a well has ceased to flow naturally and must be placed on artificial lift, there is a period of several months when it flows by heads part of the time and the remainder of the time is "on the pump." In order to determine the condition of each well after installation of pumping equipment, one operator uses a recording pressure gauge to determine well head pressures. This enables the operator to use a choke in the christmas tree even though the well is pumping, as long as he is sure that excess pressures are not encountered when the well is pumping a head of water.

The recorder is placed on one wing of the christmas tree and as soon as the well pumps off the head of water, chokes are placed in the wings. By using the continuous record of the recording gauge, a maximum well head pressure is maintained, even though the well is on the pump, thus preventing a high rate of production and resultant coning of the water into the well bore. If it is found that high pressures will continue to be recorded on the gauge, the unit may be shut down for several days until a head of salt water again accumulates in the well. The recording gauge is always on the job to act as a sentinel to advise the superintendent exactly how the well is being handled and the results obtained by such handling.

HOW TO—

Clean Gas With Shop-Made Scrubber



Where separator gas is used for drilling and lease purposes, a home made scrubber may be fabricated from scrap material. Using a joint of seven-inch casing, an inlet connection is made on the top. This connection contains a two-inch nipple with a welded ell which is placed on the inside of the pipe so that the motion of the incoming gas is directed down the section of seven-inch casing. The end nearest the inlet is orange peeled over a two-inch nipple to form the outlet. At the other end, a one-inch nipple is welded in the top. This nipple extends to the bottom of the pipe so that it will remove all of the liquid which collects in the line.

After a tripod is made to hold one

Less Cost Republic Offers

Heavy demand for crude oil and current high prices emphasize the need for modern and efficient production equipment to assure maximum output and increased profits.

REPUBLIC has the answer with its carefully selected and coordinated line of production equipment which meets every requirement from a single marginal producer to the most prolific producing lease.

For maximum efficiency at low cost call

REPUBLIC

"Your Supply Store"

Fairbanks-Morce ZC Pumping Engines are only one of the many lines of distinguished products associated with Republic Supply Service.

Republic Supply COMPANY

GENERAL OFFICES • • • HOUSTON 1, TEXAS

YOUR SUPPLY STORE

REPUBLIC SERVES YOU FROM THESE POINTS

ARKANSAS
El Dorado, Patmos

•

COLORADO
Denver

•

ILLINOIS
Chicago, Grayville
McLeansboro, Salem

•

KANSAS
Ellinwood, Russell, Wichita

•

LOUISIANA
Haynesville, Lake Charles,
Mamou, New Iberia,
Rodessa, Shreveport

•

MISSISSIPPI
Hattiesburg, Jackson

•

NEW MEXICO
Artesia, Eunice, Hobbs

•

OKLAHOMA
Bartlesville
Cement, Elmore City,
Oklahoma City,
Seminole, Tulsa

•

TEXAS
Abilene, Alice, Big Spring,
Borger, Columbus,
Corpus Christi, Dallas, Electra,
Falfurrias, Fort Worth, Freer,
Hebbronville, Houston, Kamay,
Kenedy, Kilgore, Nocona,
McAllen, Odessa, Olney,
Pampa, Pleasanton,
San Antonio, Sundown, Talco,
Victoria, Wichita Falls.

•

WYOMING
Casper

•

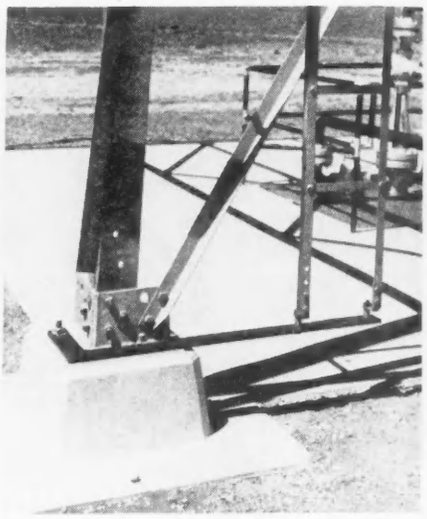
General Offices
Houston, Texas

end of the scrubber several feet higher than the other, and a short stand is made to hold the lower end, the assembly is taken to the field and the inlet, outlet, and drip lines connected. Where more than a barrel per day of liquid is collected, a float actuated steam trap is put into the liquid outlet line to keep the scrubber dry. A gage is conveniently placed on the outlet gas line where it turns back to the ground and the pressure on the upstream end of the gas line is shown.

By making the gas reverse in direction, all of the entrained liquid is made to drop out and the gas is effectively scrubbed before entering the gas line.

HOW TO—
Steady Derrick Ladder

When the ladder on a production-type derrick is extended lower than the first girt, some device or makeshift lashing generally has to be rigged up to hold the lower end firmly and rigidly. Otherwise



the lower section of the ladder would hang loosely with consequent inconvenience, if not actual danger, to the men using it.

A simple yet effective means of anchoring the lower section of the ladder has been devised by an oil company operating in Wyoming. The anchor consists of an L-shaped flat steel bracket which is fastened to the corner foundation by the derrick leg anchor bolts. As may be seen from the photograph the longer leg of the L is extended over to the lower end of the ladder to which it may be secured by two small bolts. In cases where adjustments may be required to adapt the bracket to any derrick, regardless of the height of the derrick leg foundation in relation to the height of the ladder, adjustable steel clips may be secured to the proper point by holes drilled in the lower end of the ladder uprights with connection made to the anchor iteslf through bushings made of one-half inch pipe.

Since the bracket itself supports no weight, merely serving to stabilize the bottom, preventing movement in a horizontal direction, relatively light steel may be used in its construction.

In addition, by holding the lower end of the ladder stationary the bracket tends to minimize excessive strains which would otherwise be placed upon it as it sways with the movement of workmen using it.

THAT'S THE PAGE

SUCKER ROD ON and OFF ATTACHMENT

The Page On & Off Attachment provides a quick, effective means of joining sucker rods to the pump plunger in tubing and casing pump installations. Its proven design permits removal and replacement of sucker rods without disturbing the pump plunger—a foolproof clutch-type locking mechanism eliminates chance for failure even under the severest of pumping conditions.

The success of the Page On & Off Attachment has prompted many operators to switch to larger volume pumps. The result—immediate payout for the changeover through increased production.

SIMPLE CONSTRUCTION—SIMPLE OPERATION!

Simplicity of construction is the keynote of the Page On & Off Attachment. There are no threads to gall, no complex mechanism to foul up. The tool consists of a male and female section which interfit and interlock when the sucker rods are lowered onto the pump plunger. A ¼ turn left rotates shoulders on the male section into milled out slots in the female section. During rotation a locking clutch engages by force of a helical spring positioned below it.

Disengagement of the tool requires only slight up strain and a ¼ turn right. This forces the clutching sleeve down and permits rotation of the female section for disengagement from the male section. Both the male and female sections are milled and turned from solid billits of steel and are held to close tolerances to virtually eliminate chance for wear.

Tear out this page—enclose it in an envelope and mail to Page Oil Tools, Inc., Long Beach, California, for further details.

Mid-Continent Distributors

D+B Division—Emsco Derrick & Equipment Co., Garland, Texas

The Continental Supply Company Dallas, Texas

PRODUCERS
can cut costs

For 29 years Jensen Pumping Units have been giving producers more for their money in field performance. Back of Jensen is the engineering knowledge and skilled craftsmanship needed to produce a pumping unit that will dependably stand up and produce with very little maintenance and repairs. This, combined with the low operating and initial costs, means a unit that producers can count on to cut costs.

For information of Jensen dependability, see your Jensen dealer or write to Coffeyville for free literature.

JENSEN
Bros. Mfg. Co., Coffeyville, Kan.

Export Office: 50 CHURCH STREET, NEW YORK CITY

"VIC" TELLS HOW

ONLY A T-WRENCH IS NEEDED TO BUTTON UP 2-BOLT VICTAULIC COUPLINGS!

ANY PIPING SYSTEM can be buttoned up by a few fast turns of a standard T-wrench . . . when you use Victaulic Couplings with their famous 2-bolt simplicity.

YOU SAVE time and cut labor costs, too . . . because Victaulic Couplings are so fast and easy to install that no specially trained or skilled labor is needed.

ADD FULL-FLOW Victaulic Elbows, Tees, and other Fittings and you'll not only increase the output of your pipeline . . . you'll also lower your pumping costs!

USE THE NEW "Vic-Groover" and find out how it grooves pipe ends twice as fast . . . with half the effort of ordinary pipe threaders!

WRITE TODAY for these two: Victaulic Catalog and Engineering Manual No. 44. "Vic-Groover" Catalog No. VG-47.

Sizes—¾" through 60"

FOR FULL ECONOMY...MAKE YOUR PIPING SYSTEM ALL VICTAULIC!

SELF-ALIGNING PIPE COUPLINGS

VICTAULIC

EFFICIENT FULL-FLOW FITTINGS

VICTAULIC COMPANY OF AMERICA

30 ROCKEFELLER PLAZA, N. Y. 20, N. Y.

Victaulic Inc., 727 W. 7th St., Los Angeles 14, Cal.
Victaulic Co. of Can. Ltd. 200 Bay St., Toronto 1

For Export outside U. S. and Canada: PIPECO Couplings and Fittings · Pipe Couplings, Inc., 30 Rockefeller Plaza, New York 20, N. Y.

Copyright 1949, by Victaulic Co. of America

PRODUCTION HINTS

HOW TO—
Build Deadline Anchor

A problem frequently encountered on producing wells equipped with wooden derricks is the matter of providing a suitable deadline anchor whenever the well is pulled or serviced. One major

company employs a simple anchor device which may be bolted to the inside angle of the derrick leg base. A 2- or 3-foot length of heavy angle iron is folded in upon itself for the top six or eight inches and welded together, a round hole then being burned through the center of the "flat" thus created. Additional strength is given to the angle by welding a triangular piece of plate in the throat area just below the folded-over section. A steel loop then is passed through the hole and it is in turn welded closed. Bolted or lag-screwed to the derrick leg, this effective, easily accessible deadline anchor occupies space that is not needed for other operations.

HOW TO—
Ease Gauger's Duties

Where small tanks are used on a lease and it is necessary for the gauger to make several trips a week to the battery, a flag may be stuck into one of the gate posts to notify the gauger that a tank is ready to run into the pipe line, or if the pumper desires a tank on the line to be shut off.

The flag pictured is made from a piece of sucker rod with a foot-square section of corrugated iron for the flag. The flag may be painted red or black

so that it shows up from the highway when the gauger is making his rounds. As soon as the gauger performs the work indicated by the pumper, he removes the flag from the gate post and

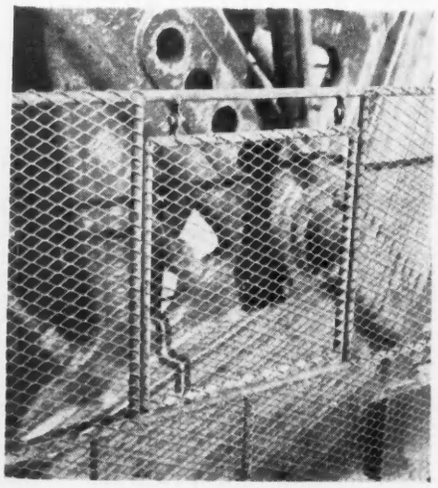
the pumper can look out from his dog house and determine whether the gauger has made his battery.

A size No. 1 tin can is placed upright on the other gate post and a size No. 2 can is inverted over it to hold the run tickets.

HOW TO—

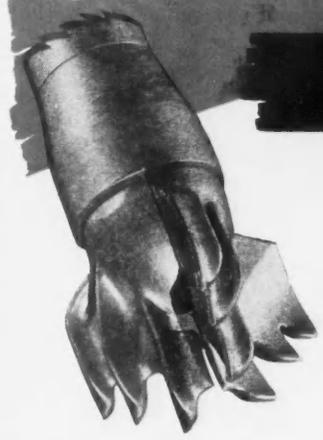
Make Safety Opening

The danger of a pumper being seriously injured by the pitman, crank or counterbalance while oiling up has prompted many companies to totally enclose the equipment with a heavy wire mesh or expanded metal fence. To permit the pumper to service bearings regularly without having to remove an entire section of the fencing, one company designs their enclosures to include a two-



"ON THE DRILL" BIT SERVICE

A "Natural" for foreign seismograph operations



In foreign seismograph drilling, where repair shops are often hundreds of miles from the drilling location, bit service is a problem of paramount importance.

There is no "bit service" problem when you use Hawthorne Replaceable Blade Bits. Twelve sets of blades weighing only 2 to 3 pounds per set, come in convenient, plainly marked boxes that are easily carried with the drill. To service the bit it is necessary only to unscrew the locking ring and replace the worn blades. This is done in a few minutes time with tools regularly available.

And you need not carry large inventories of bits as compared to conventional drag bits and roller bits because one bit head assembly lasts for many sets of blades.

"ROCK CUTTER" BLADES

for faster, more economical "all formation" drilling

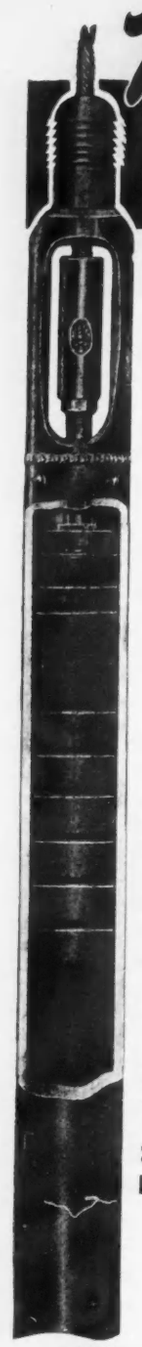
Patents Pending

Hawthorne Replaceable Blade "Rock Cutter" Bits have proved capable of drilling more hole in soft formations in less time than conventional type drag bits. Furthermore, these blades successfully drill broken formations and many rock formations that have previously required roller bits. This means faster drilling, fewer round trips to change bits and lower bit costs. Operators have reported bit savings of over 50% with increased drilling speeds over 33⅓%.

Hawthorne Replaceable Blade "Rock Cutter" Bits are available in a range of sizes to fit any drill. For full information, write for our bit catalog today.

HERB J. HAWTHORNE INC.

P. O. BOX 7299 HOUSTON 8, TEXAS



Miller

SAND PUMPS

Standard Clean-out Tool for 25 Years

Check any oil field in the world where sediment or sand is met with and you'll find Miller Sand Pumps and Bailers are standard . . . leadership earned and held by continuous improvements during 25 years of service!

The Miller Sand Pump is made in Regular and Heavy Duty types in sizes listed below. Lug type Chisel, Sand and Bailer Bottoms are easily interchanged.

Threaded Chisel and Sand Bottoms can be supplied, to permit larger pieces of sediment to pass, and pump to be dumped without removing bottoms. Tool Pin bail allows tools and sand pump to be run on same wire line when desired.

Write for new descriptive price list on Miller Sand Pumps and Bailers. See Composite Catalogue page 2666 for details.

SAND PUMP AND BAILER SIZES:

Outside Diameter
2½"
3"
3½"
4¼"
5"
5½"
7"

Lengths
20 feet
25 "
30 "

Special Sizes and Lengths to Order!

EXPORT OFFICE
30 Rockefeller Plaza
New York 20, New York

MILLER SAND PUMP CO.
1524 S. E. 29 • Box 4516
OKLAHOMA CITY 9, OKLAHOMA

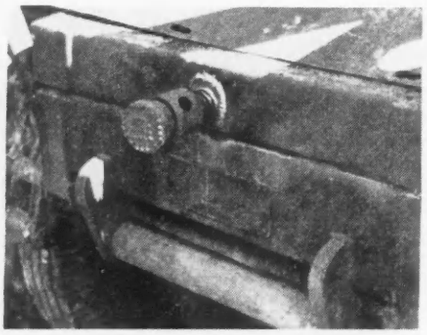
PRODUCTION HINTS

foot square opening at the point opposite the crank where the pumper can reach the bearing and grease fittings, working at arm's length outside the enclosure. Use was made of the same three-quarter-inch sucker rod material used in the framework of the fence to construct a close-fitting panel which was hung on hinges made from light sprocket chain. By being hinged at the top in the manner illustrated, the gate always will remain closed by its own weight. This assures the field man that the panel always will remain closed. A small metal tab welded to either side of the opening prevents the gate from being swung inward.

HOW TO—

Construct Tightener

Where the pulling unit is placed near the derrick floor, it is necessary to have a bumper bar between the pulling unit and the derrick floor. After the wheel blocks are in place, the bumper bar



placed between the back of the pulling unit and the girt on the derrick floor, the tightener shown in the illustration finds its application.

The bar is placed against the head of a screw jack and the jack is extended in the same manner as it is used for hoisting. The top of the jack is fastened into the back of the bed of the pulling unit by cutting the shank off of the jack with a welding torch and setting the stem and top nut into a hole cut into the back of the bed. This nut is welded to the back of the bed with the top of the jack protruding. The jack is maintained in the retracted position until the truck is spotted at the location. The jack is then extended to make a tight connection between the pulling unit and the rig.

No— But No
Bulky Containers

CAN-IN-HAND
Goes Farther
And
Does More

• • •

SAND-BANUM
Safely and Surely
Removes AND Prevents
Boiler Scale and Corrosion

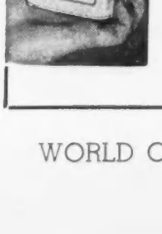
• • •

SAND-BANUM
Protects Your Boiler
Reduces Your Fuel Bills
Saves on Freight Charges
Lessens Storage Space

• • •

CAN YOU
Afford to Miss
These Advantages?

Be Skeptical—
WRITE
For Data



"The Entirely Different Boiler and Engine Treatment"

AMERICAN SAND-BANUM COMPANY, Inc.
9 ROCKEFELLER PLAZA,
NEW YORK CITY 20

FIGURE 1. Panhandle Eastern's circular computer consists of three aluminum plates carrying scales and attached to a turntable so that settings may be made to enable throughput of the line to be accurately determined from the charts.

By F. C. WALTERS

Superintendent, Transmission Gas Measurement
Panhandle Eastern Pipe Line Company

SUPERCOMPRESSIBILITY factors for natural gas are important in determining performance of natural gas transmission lines. A computer, designed to eliminate use of charts or tables, facilitates meter chart calculation and is readily adaptable to clerical interpretation. The author describes this computer and illustrates its calibration.

A CIRCULAR computer for the direct reading of supercompressibility factors for natural gas has been developed by the Panhandle Eastern Pipe Line Company. The computer, Figure 1, will indicate with one setting the value of supercompressibility factors to the fourth place past the decimal for both displacement meter and orifice meter measurements. The first computer has been in use in Panhandle Eastern's gas measurement office since early April of this year. The computer has been found to facilitate meter chart calculation procedure since it eliminates the necessity of reading supercompressibility factors from curves or tables. It has also been found to be readily adaptable to clerical interpretation.

The computer is composed of three polished aluminum plates on which the scales are etched. The outer plate is an annular ring containing the pressure scales and is permanently fixed to a turntable so that the "read" pressure may be brought to proper eye level to facilitate reading. The inner plate, containing the supercompressibility factors, is circular and is also fixed to the turntable except that its position with respect to the pressure scales may be varied in order to calibrate the computer against periodic determinations. After calibrating, it can be fixed in position with the use of set screws provided on its underside. The top plate, containing the index and temperature scales, is a circular segment and rotates on its center. A tilted wooden base, 15 x 15 inches, supports the turntable on which is mounted the computer. The diameter of the computer is 14 inches. The combined weight of the instrument is six pounds.

The computer is based on an empirical equation which is generally accepted in the standard practice of natural gas companies. The development and application of the equation is set forth in the California Natural Gasoline Association Bulletin No. TS-354, dated 1936, and entitled

"Tentative Standards for the Determination of Superexpansibility Factors in High Pressure Gas Measurements." The equation may be expressed as follows:

$$N = \frac{KP}{T^{3.825}}$$

where N = Deviation from Boyle's Law —a decimal
K = A constant
P = Static pressure—pounds per square inch gauge
T = Absolute temperature — degrees Fahrenheit

In principle, the computer is a circular slide rule from which may be read directly the supercompressibility factors to be used in displacement and orifice meter calculations. Since the supercompressibility factor varies with the pressure and temperature of a gas, the pressure, temperature, and supercompressibility factor scales are incorporated on the computer.

Two Pressure Scales

To facilitate accurate reading, the computer incorporates two pressure scales, the low pressure scale ranging from 5 to 100 pounds per square inch gauge and the high pressure scale ranging from 50 to 1000 psig. The temperature scales range from 0° F. to 100° F. The supercompressibility factor for displacement meters is denoted as F_d and for orifice meters as F_o. To avoid crowding the notation on the supercompressibility factor scales, the scale notation is limited to the last significant figures of four places past the decimal point, except where the number of the significant figures changes from one to two, two to three, etc. At these points the entire factor is shown in slanted figures.

Since the value of the constant K in the above equation varies with the composition of the gas, the computer can be calibrated by setting known temperature and pressure conditions against the value of the supercompressibility factor determined at those conditions and by locking in place (in the proper position) the circular section of the computer on which is shown the correction factors.

Example of Calibration

From a test, the deviation from Boyle's Law is 0.0672 at a pressure of 400 psig and a gas temperature of 60° F. Since F_d is equal to $(1 + N)$, its value is equal to 1.0672 at the above temperature and pressure conditions. Therefore, to calibrate the computer, the index is set at 400 pounds per square inch on the high pressure scale and the segment on which is shown the supercompressibility factor scales is rotated so that the value 1.0672 (F_d) on the scale marked "Correction Factors for High Pressure Scale" is in line with 60 on the scale marked "°F. for H.P. Scale." The segment on which is shown the supercompressibility factor scales is then locked in position by means of set screws. The temperature scale then becomes the only moving part of the computer.

Following a calibration of the computer, it is then necessary only to set the index at the required gas pressure and to read the supercompressibility factor F_d or F_o opposite the applicable gas temperature on the proper scale.

The calibration of a computer will depend upon the frequency of supercompressibility tests or determinations. Some companies use average values as long as such values remain within a set tolerance. Others carry out periodic tests or determinations and apply such results during interim periods. Upon consideration of general operating practices, it is evident that calibration of the computer in most instances will be fairly infrequent. Where factors must be applied in routine operations to gases of different characteristics, the recalibration of one computer for each group of meter charts would be feasible if not required too frequently. The computer has been arranged so that calibration is a simple and fast operation taking only a few minutes to perform. In some instances, however, it might be desirable to calibrate and assign an individual computer for the handling of each group of charts.

The computer has been copyrighted by Panhandle Eastern Pipe Line Company and arrangements are being made for its manufacture.

About the Author

FAY C. WALTERS, a native of Oklahoma, has been superintendent of transmission gas measurement for Panhandle Eastern Pipe Line Company for more than 17 years. Previously, he was associated with Oklahoma Natural Gas Company at Tulsa. He has served on the general and executive committees of the Southwestern Gas Measurement Short Course. He was graduated from the School of Chemical Engineering at the University of Kansas.

FIGURE 2. Scales used on the three disks of the computer, showing arrangement of low and high pressure values and interrelation of correction factors.

HERE'S HOW PITTSBURGH'S

hydro-lube

assures circulating lubrication

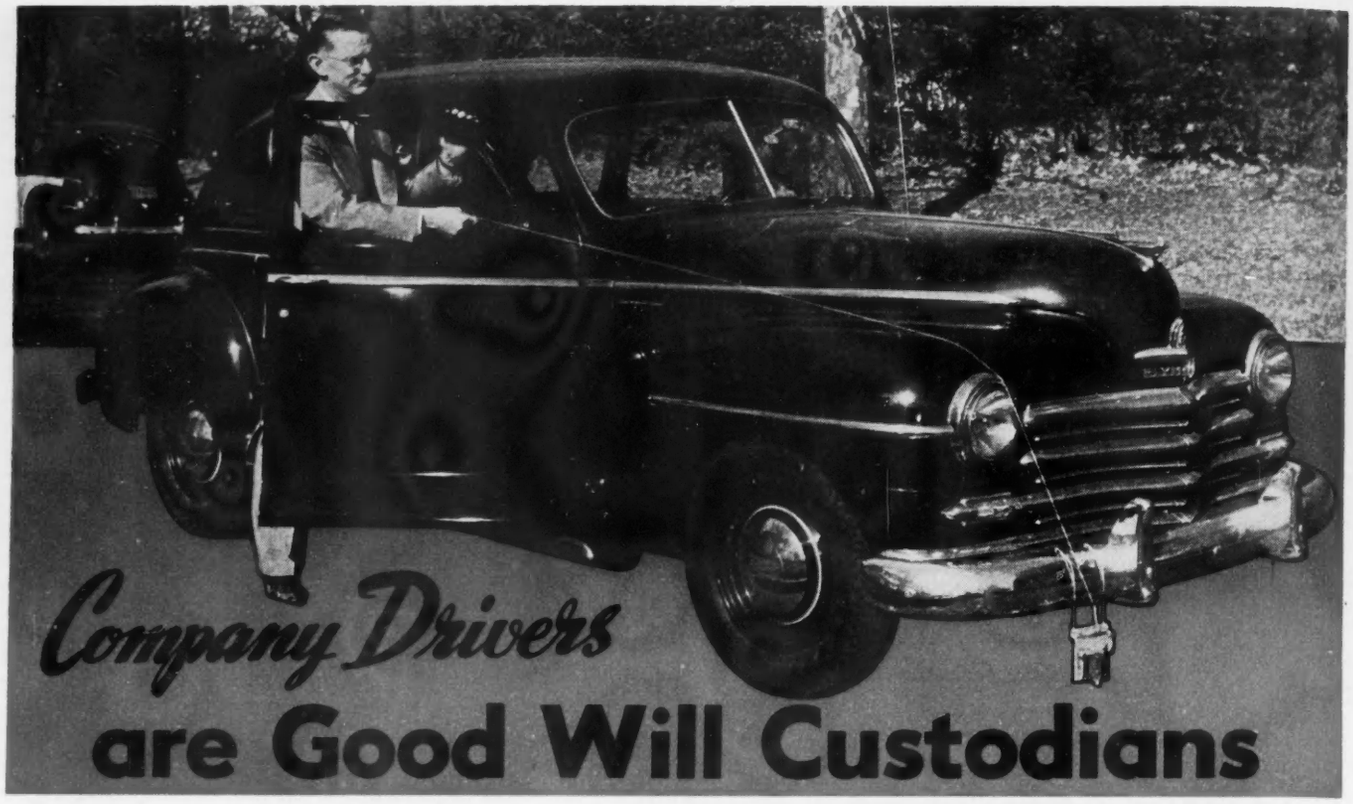
1 EVERY TIME VALVE IS OPENED OR CLOSED . . .
2 . . . THIS PISTON FORCES THE LUBRICANT THROUGH THE PLUG AND BODY DUCTS . . .
3 . . . LUBRICATING ALL CONTACT SURFACES
PITTS

Available in 175 lb. W.O.G. and 500 lb. W.O.G.

WRITE FOR FREE BOOKLET

PITTSBURGH

SINCE 1902
PITTSBURGH VALVE & FITTINGS CORP.
BARBERTON, OHIO, U.S.A.



Company Drivers are Good Will Custodians

—All photos in this article courtesy Stanolind Oil and Gas Company

S. S. Allen, Stanolind driver training instructor, shows how the detonator is fired by pulling string. The detonator fires a piece which marks the pavement at that spot.

By ELTON STERRETT
Engineering Editor

EVERY vehicle which bears the name of an oil company is a factor in the good will which the owner may enjoy or, in the hands of a heedless or reckless driver, is as potent as contributor to the ill will which accrues to the company through little acts of discourtesy or just plain road-hoggishness.

The marketing branches of the oil industry have long been awake to the value of leaving pleasant associations with every appearance of the company name, as witness the "Blow Your Horn and Half the Road's Yours" messages in six inch letters across the back panels of some transport tanks. But the operating end of the industry, especially the production and pipe line branches, thereof, have not been as careful to see that the company name is synonymous with a good impression. All too often the gang truck, rushing to a line break or other emergency, is apt to take—in the mind of the driver, at least—all the importance of an ambulance speeding to a disaster, and the motoring public is apt to resent the apparent slight without investigating the reason behind the big hurry.

Safety campaigns, good-driver awards and other means of keeping the principles of "mutual benefit" driving before the men in charge of the company's automotive equipment go a long way toward making safe, careful, considerate driving a part of the job for the truck or service-car driver, although many companies are content to accept the job applicant's commercial car license as ample proof of his ability to do all that is expected of him in safeguarding the company's property and good name on the highways.

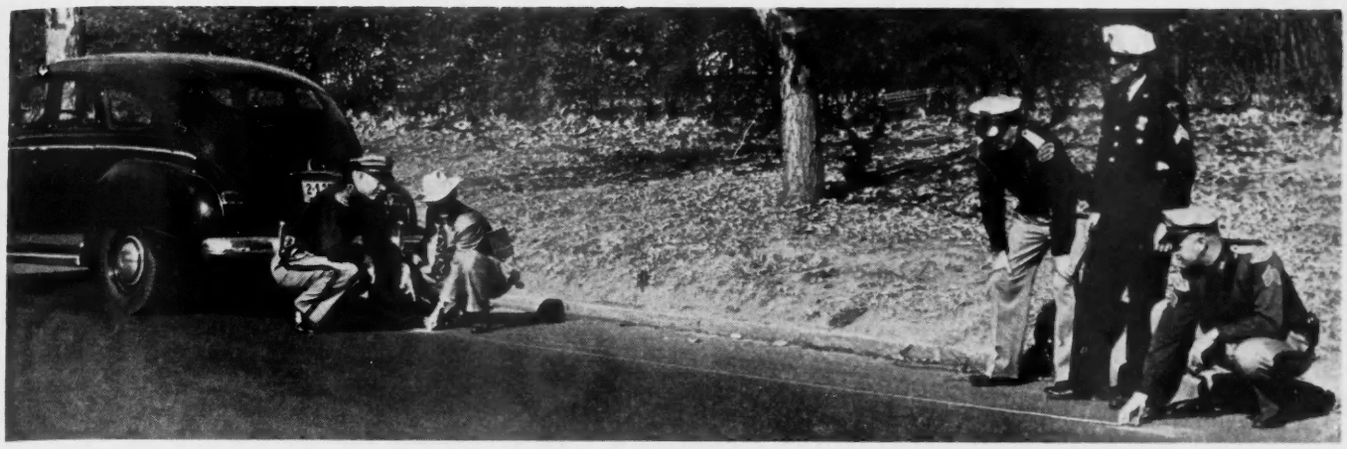
What is believed to be the first attempt to follow up on a driver's training, and to be sure that he is a good custodian of company good will, is the training course given all drivers by Stanolind Oil & Gas Company. The course, given with the cooperation of the Oklahoma Highway Patrol and the Automobile Club of Oklahoma to men residing within that state, covers two hours of intensive work. Already more than 2000 Stanolind employes have learned firsthand about their own limitations in operating cars and trucks. They have also had a good review of traffic regulations.

Stanolind installed the course in an effort to cut its motor vehicle accident rate, which is already one of the lowest in the oil industry. More than 1800 company drivers in 11 states have completed the training. The last several hundred are general office employees who are now being given the course.

During the two hours of testing, each driver takes vision tests and reaction time checks. He also goes through an actual driving run with a competent instructor. Thus he is made more conscious of his own driving habits and his ability to control a moving vehicle.

Just how long it takes to stop a moving car is illustrated dramatically through use of the detonator. This is a device which is loaded with two .22 caliber blank cartridges. One is fired by the instructor as a signal to the driver to stop; the second fires automatically when the car's braking action begins. Each cartridge shoots a piece of chalk to the pavement, marking the spot where it was fired.

The distance between the chalk marks shows how long it took the driver to get his foot off the accelerator and on to the brake. The actual braking distance is measured from the second chalk mark to the front of the car. On the average, it takes 42 feet to stop a car travelling 20 miles an hour. But most drivers find



Measuring the distance between chalk marks following a detonator test.

it hard to believe the car moved that far before stopping.

Typical remarks heard after the test range from "I didn't realize the car would travel that far!" to "I don't believe it. Let me try it again." Sometimes drivers repeat the test several times before they are convinced.

Simple mechanical devices are used in testing the driver's vision. The first measures his field of vision—the over-all area he can see while looking straight ahead. Seated at the device, the driver looks straight ahead while white pegs are moved forward along the sides of the instrument. As soon as he sees the pegs moving, they are stopped and his field of vision is noted.

The second device checks visual acuity, or sharpness of vision with respect to picking out details. The trainee looks into a mirror and reads from charts reflected in it.

The depth perception (distance judgment) test requires the trainee to look into a mirror and line up three toy automobiles on moving tracks. The test is similar to that given pilots.

A fourth device clocks a driver's reaction time. He sits before a mock-up automobile floorboard with his foot on the accelerator. When a red light flashes, he applies the "brakes" as fast as possible. His reaction time is measured in hundredths of a second.

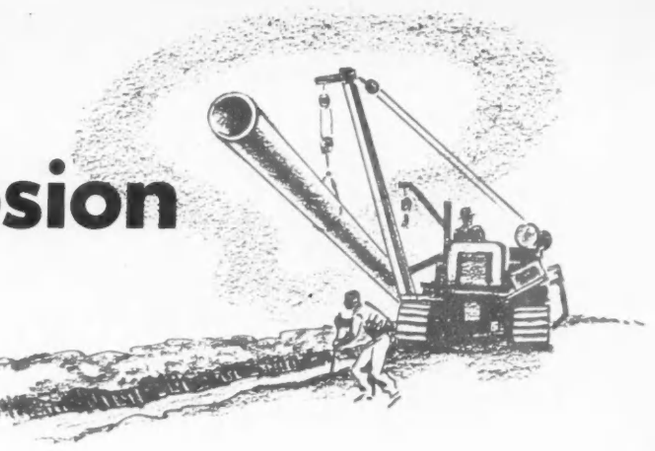
Stanolind's driver training program was begun in January, 1948, when 18 company men were taken to Tulsa for a 30-hour training course under Trooper O. B. Patterson of the Patrol. The 18 men became company instructors and have handled the training of the 2000 drivers. Instructing the course at Tulsa is S. S. Allen of Oklahoma City.

The company has established permanent driver training committees in each of its four divisions. The course will be given to all new employes who drive company cars and trucks. Instructors will also do further work with employes who demonstrated poor driving habits in the first tests.

Measuring the distance needed to stop a car traveling 20 miles per hour.

J. G. Potter, Stanolind employe, takes foot reaction time test as Allen operates panel. "Driver" holds foot on accelerator until light changes from green to red; then he steps on brake pedal.

Plastic Coatings And Corrosion



By C. G. MUNGER
Director of Research, Amercoat Division
American Pipe & Construction Company

PLASTIC coatings in recent years have become more and more important in their relationship to the prevention of corrosion. By plastic coatings are meant only those materials which contain purely plastic materials and not those paints and coatings which are made up of oil, varnishes, natural resins and synthetic varnish resins such as the alkyds. These are important in their particular fields; however, they are comparatively old products and have been studied for years. Most of the plastic resins are comparatively new, having been developed within the last 15 years. While it is true that nitrocellulose coatings or lacquers and baked phenolic coatings have been known for a period of many years, these should be included in the plastic coating series since they are actually plastic materials.

In the extensive work done by our organization in the formulation of plastic coatings, the properties of one group of plastics have been outstanding. This is the vinyl chloride and vinyl chloride copolymer group of resins. They provide films with hardness, toughness, and high tensile strength. The chemical resistance of these resins is outstanding. They are unaffected by mineral acids with the exception of concentrated sulfuric. They are unaffected by concentrated solutions of caustic soda, temperatures as high as 230° - 250° F. They are unaffected by salt solutions such as ammonium nitrate, sodium chloride, magnesium and calcium chloride, ferric chloride, copper sulfate and similar materials. Moisture absorption is low; moisture vapor transfer is low; they are odorless, tasteless, non-toxic, non-flammable.

VINYL CHLORIDE and vinyl chloride copolymer groups of resins are considered in the light of their chemical and water-resistant properties and various phenomena of osmosis and electroendosmosis evaluated in their effects on the success of corrosion-preventive coatings. The studies are of especial value in the protection of tubular goods and tank structures.

Second Factor

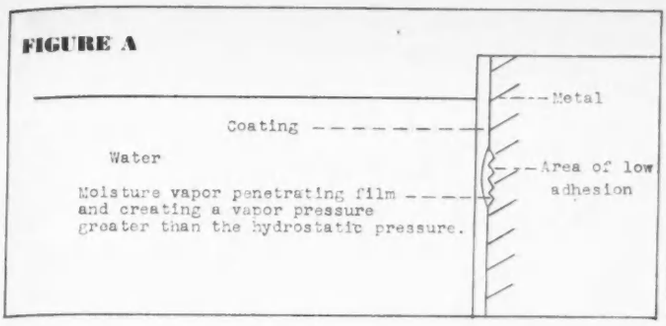
Starting with a material of the above chemical and physical properties, the second factor of a successful corrosion resistant coating enters the picture; that is, the factor of proper formulation for specific chemical or corrosion resistance and resistance to moisture and moisture vapor transfer. It is felt that the factor of impermeability and high moisture vapor transfer resistance is of the utmost importance in a corrosion resistant coating. The quality of impenetrability by chemicals is obvious. Resistance to moisture vapor transmission, however, is somewhat more subtle. It is the general consensus that distilled water is one of the most difficult materials for a coating to resist. Blistering, loss of adhesion, and penetration of the coating by water are the most obvious types of failure. It is felt that moisture can cause the failure of a synthetic resin coating by three means.

The first is by direct moisture-vapor transmission into an area under the coating where the adhesion is poor, or into a porous spot, pore or void in the material over which the coating has been applied. In either case it is possible for the moisture vapor to pass through the coating, set up a vapor pressure in the area which is conceivably greater than the hydrostatic pressure of the liquid on the outside of the coating. In such a case blisters would form with no appreciable water or liquid in them. Such blisters have been encountered many times in actual applications (Figure A).

The second type of failure is believed caused by osmosis. Osmosis can be defined as the passage of water through a semi-permeable membrane from a solution of lesser concentration to a solution of higher concentration. For example, take a water tank which has been painted. The coating has been applied over some rust. In this case the coating is a semi-permeable membrane and the first reaction is that of moisture-vapor passing through the film and being absorbed by the rust or other soluble material on the coated surface (example, sweat from handling with bare hands). In so doing the rust has a slight tendency to hydrolyze and go into solution as ferrous hydroxide. This creates a solution with a higher concentration of solutes in solution than the water on the exterior of the film contains. In other words, the osmotic pressure of the ferrous hydroxide solution under the film is considerably higher than the osmotic pressure of the water on the exterior of the film. In such a system water passes through the semi-permeable membrane in the direction of the more concentrated solution or the solution with the higher osmotic pressure (Figure B).

As the water passes through the film, blisters form and eventually can rupture allowing free access of the water to the metal. Actually, such a reaction can take place through the action of moisture vapor alone as is shown in the attached diagram. This can account for considerable blistering and coating failure even where the coating is not subject to continual immersion. absorption of moisture vapor through the coating film causes much of the rust growth underneath paints which is characteristic of areas of high humidity (Figure C).

The third type of failure where moisture is a factor is that caused by electroendosmosis. Electroendosmosis can be defined as the passage of liquid through a membrane under the force of an applied electric current. The direction of the migration of water through the mem-



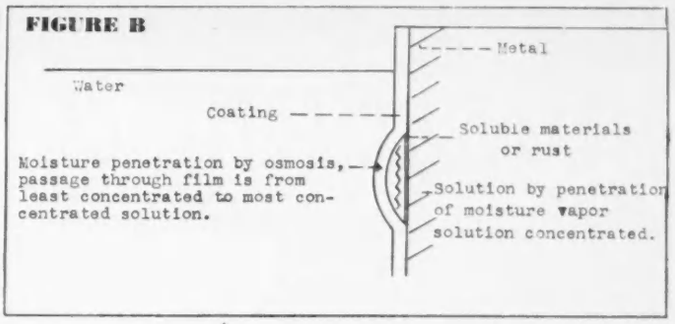


FIGURE B
Metal
Water
Coating
Soluble materials or rust
Moisture penetration by osmosis, passage through film is from least concentrated to most concentrated solution.
Solution by penetration of moisture vapor solution concentrated.

brane is toward the pole which has the same sign as is possessed by the membrane. Using this definition and the fact that an electric potential is set up between coated and uncoated areas of the same metal surface, the possibility of an electroendosmetic effect can easily be seen. A. C. Elm of the Research Division, Technical department of the New Jersey Zinc Company,[1] states that the direction of the moisture or water can be toward either the anode or the cathode depending upon the charge on the paint film. It has been the experience of this company that most of the paint films they have examined carried negative charges; therefore, the movement of the water through the film was toward the cathode (Figure D). Using this concept, then, it is easy to understand the blistered areas which many times form around a spot of corrosion under a coating.

It can be seen from these three effects, all of which are caused by moisture in one form or another, that the formulation of a coating to resist severe corrosive influences must be formulated as well for a minimum of moisture-vapor transmission. This can be accomplished assuming a basically chemical moisture resistant material such as vinyl chloride plastic, by the use of hydrophobic pigments, highly water resistant plasticizers, and the use of plate type pigments which form a shingle effect in the film when dry. Such pigments are aluminum flake, mica, talc and an even newer material, stainless steel flake.

The effect of the three above forces on coatings has been demonstrated many times in the use of plastic coatings for resistance to chemicals. As an example, vinyl chloride coatings have been developed for caustic soda storage tanks. Caustic does not affect the vinyl chloride; however, the efficiency of the coating increases directly as the concentration of the caustic solution. A dilute solution will cause blisters and coating failure at a much lower temperature than concentrated solutions. At 70 percent concentrations the coating is unaffected by continuous immersion at 230° F.

Adhesion, the third factor mentioned above, is pretty obvious since without adhesion the coating would be wholly ineffective against either physical or chemical forces.

Repairing the Surface

The last factor which is believed to be essential for corrosion resistant coatings is that of application and surface preparation. While this may be true with all coatings, it is felt that it is especially true for synthetic resin plastic coatings, since these materials are used for resistance to extreme corrosion and where extreme chemical resistance is a factor. There are two factors in preparation of the surface. The first is to make sure that the surface is free from all foreign material such as dirt, grease, rust, scale. The second is that of increasing surface area by breaking up the surface so as to provide increased mechanical adhesion.

The following is a list of methods of surface preparation in order of decreasing effectiveness:

Sandblasting
Pickling
Flame treatment
Chip and wire brush

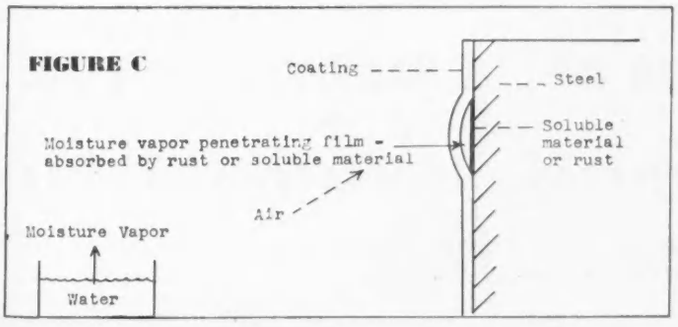
The application of the coating after the preparation of the surface is of equal importance. The first is the application of multiple coats. This provides for appreciable film thickness, reduces to a minimum the possibility of pinholes, holidays and missed areas, and tends to equalize hills and valleys in the surface over which the coating is to be applied. Multiple coats are most important in plastic coatings since due to low solubility of the basic materials, the non-volatile content of the basic solutions is low. A second factor which is related to the multiple coats is that of varying the color between coats. While this is not essential, it materially aids in obtaining full coverage of every coat and helps reduce the possibility of pinholes and holidays.

A third factor in the application is to make sure that once applied the coating is thoroughly dry. The solvents in the formulation are oftentimes the most reactive and least chemical resistant elements in the plastic coating and unless they are completely removed, can in the case of a coating used for chemical exposure, cause the breakdown of the coating.

The use of plastic coatings formulated with specific chemical resistance, high resistance to moisture vapor transmission, excellent adhesion and properly applied is extremely wide. Following are some examples in the use of such coatings in a number of widely different fields.

In the last few years sour crude has created extensive corrosion problems which extend from the bottom of the well up through the well tubing into the field tanks; from the field tanks through the pipe lines to pumping stations; and from the pumping stations into the refineries. Plastic coatings have materially reduced this corrosion problem. They have been applied both as the phenolic

■ CONTINUED ON PAGE 180



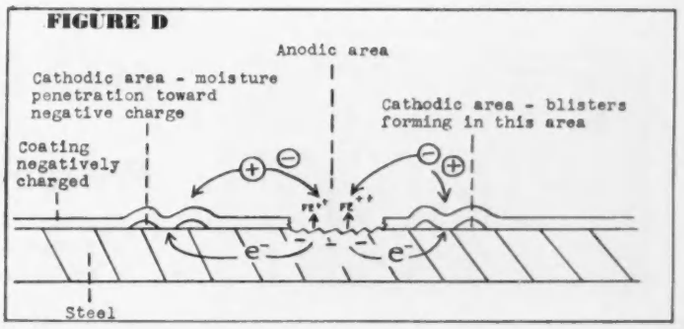


FIGURE D
Anodic area
Cathodic area - moisture penetration toward negative charge
Cathodic area - blisters forming in this area
Coating negatively charged
Steel

Versatility of Design...

STURDYBILT *Prefabricated Demountable Houses*

•

MANUFACTURERS OF SPECIAL MILLWORK: DISTRIBUTORS OF JOHNS-MANVILLE BUILDING MATERIALS; CURTIS WOODWORK

•

The above STURDYBILT house, although not a stock design, was constructed of standard 4′ x 8′ STURDYBILT wall sections. As a rule standard STURDYBILT designs will suit your housing needs; are more readily available and less costly. However, special homes, garages, warehouses, or dormitories can be erected from STURDYBILT sections whenever necessary. Whatever your field housing needs . . . investigate STURDYBILT prefabricated, demountable houses *first.*

STURDYBILT

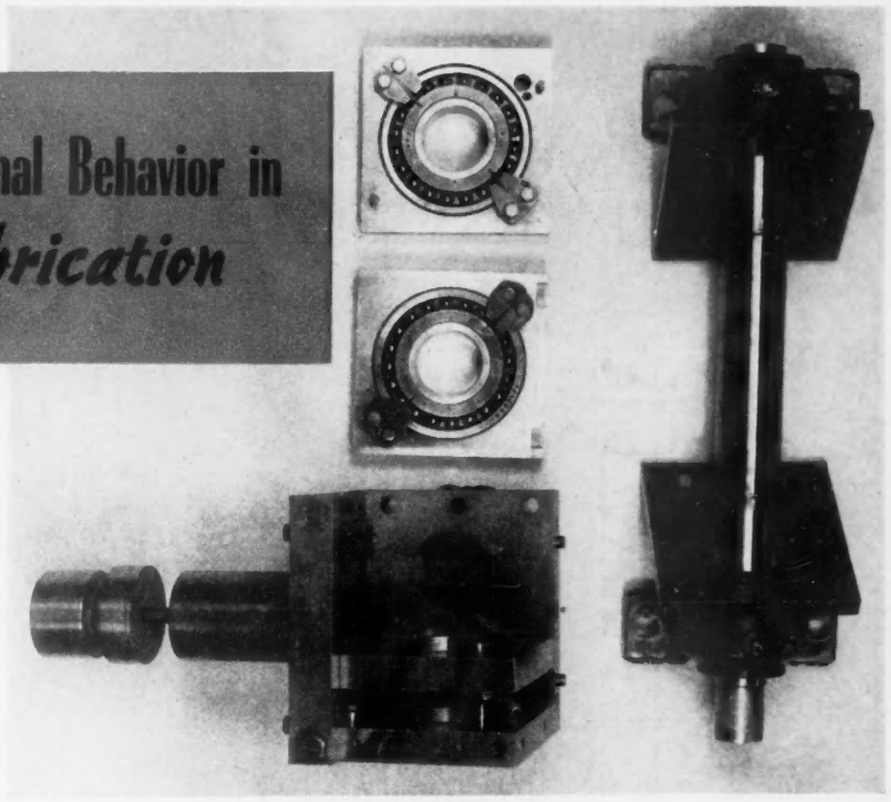
SOUTHERN MILL & MANUFACTURING CO.

• TULSA, OKLAHOMA •

Prefabricated, Demountable Houses

STURDYBILT HOUSES COMPLY WITH COMMERCIAL STANDARD CS125-45 OF THE NATIONAL BUREAU OF STANDARDS FOR PREFABRICATED HOMES

Fractional and Thermal Behavior in *Bearing Lubrication*



STUDY OF bearing operation under closely observed conditions of pressure, temperature and lubrication feed provides correlation between fluidity and pressure in estimating safe bearing loads under operating conditions. A series of curves, for ball bearings of specified design and with full-flow lubrication, gives data for lubricants of various viscosities.

FIGURE 1. The four-bearing machine developed at the National Bureau of Standards consists essentially of four test bearings on a common shaft. The bearings are mounted in self-aligning ball-bearing swivels which are prevented from rotating by flat springs. The two outer bearings are fastened to the housing, while the two inner ones are located in plates that slide in guides. The complete housing floats on the horizontal shaft and acts as a cradle dynamometer. Load is applied by hydraulic jacks under the two inner bearings.

THE operation of a journal bearing under a steady state of temperature distribution with forced-feed lubrication is dependent upon a number of factors related both to the conditions of operation and to the geometry of the bearing. The relation of these factors to the performance of the bearing is very complex, involving both the rate at which the heat is generated in the bearing and the rate at which it is carried away. In an extensive investigation of these factors at the National Bureau of Standards,[1] using a four-bearing friction machine, a method was developed for studying bearing performance through measurements of the combined frictional and thermal behavior in journal-bearing lubrication. These investigations also led to a practical graphical procedure for estimating safe bearing loads.

The work involved operation of bearings of two diameters, in two length-diameter ratios and three clearance-diameter ratios, and at two journal speeds. Three oils, of different viscosities, were used at three oil-inlet temperatures. Particular attention was given to the resultant effects of the combined hydrodynamic and thermodynamic actions involved in bearing operation with forced-feed lubrication.

The four-bearing friction machine, developed and used in former investigations at the National Bureau of Standards, consists essentially of four test bearings on a common shaft. The bearings are mounted in self-aligning ball-bearing swivels which are prevented from rotating by flat springs. The two outer bearings are fastened to the housing while the two inner ones are located in plates that slide in guides (Figure 1). The complete housing floats on the horizontal shaft and acts as a cradle dynamometer. Load is applied by hydraulic jacks under the two inner bearings.

Oil Feeding

Oil is fed to the bearings through the drilled shaft, which has two oil holes at the longitudinal center of each bearing. A motor-driven pump and a relief valve maintain the oil-feed pressure. Bearing temperatures are measured by thermocouples imbedded in the metal at the loaded sides of the bearings.

A study of the frictional-torque data for operation under load indicates that when a bearing is operating at a constant speed, using a given oil at constant oil-inlet temperature and oil-feed pressure, an increase in load produces an approximately proportional increase in frictional-torque. The increase in torque with unit increase in load is influenced chiefly by the viscosity of the oil, the oil-inlet temperature, the oil-feed pressure, the clearance-diameter ratio, and the length-diameter ratio.

Results also indicate that, under these operating conditions, an increase in load causes a proportional increase in the fluidity of the oil in the bearing. For a given oil, oil-inlet temperature, and oil-feed pressure, this increase in fluidity (reciprocal of viscosity) is a function of the speed of the journal, the diameter of the journal, the length-diameter ratio, and the clearance-diameter ratio. Empirical equations have been developed to define this relationship.

The straight-line relationship between fluidity and pressure provides a graphical means for estimating safe loads. The limit for safe operation is based upon a

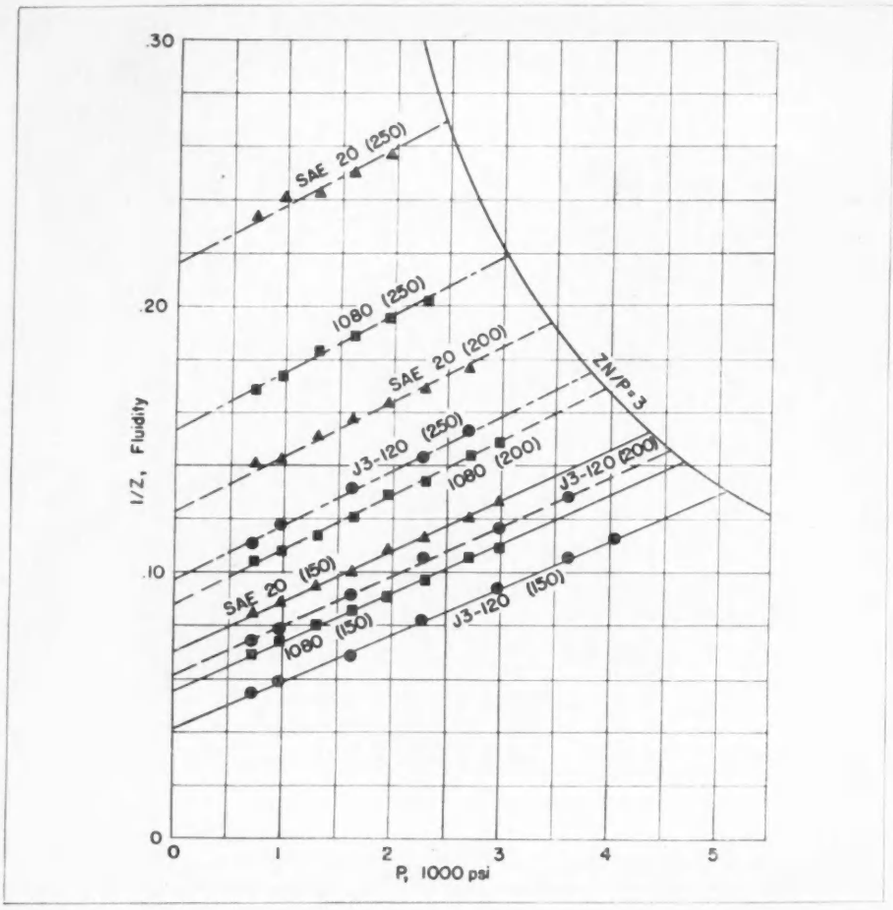


FIGURE 2. Graphs illustrating the usefulness of the straight-line relationship between fluidity and pressure in estimating safe bearing loads for various grades of lubricating oils. These particular graphs show the effect of fluidity on safe operating pressures for 2 x 1¼-inch copper-lead bearings (length-diameter ratio of 0.620 and diametral-clearance diameter ratio of 556) at 2000 revolutions per minute and 35 pounds per square inch average oil pressure. Figures in parentheses indicate oil-inlet temperature in °F. For this chart a minimum limiting value of 3 was plotted for the generalized operating variable, ZN/P. The intersection of ZN/P = 3 and a specific fluidity curve gives the maximum safe operating load for the conditions indicated.

minimum value of a generalized operating variable, ZN/P, where Z is the absolute viscosity of the lubricant, N is the speed of the journal, and P is the pressure on the bearing. The intersection of a line representing a limiting value of this variable with the straight line drawn through the fluidity-pressure data for a given set of conditions gives directly the safe bearing pressure for these conditions (See Figure 2).

Heat Loss Factor

In analyzing these results it is emphasized that the thermal behavior of a journal bearing operating with forced-feed lubrication is dependent upon a complex relation that involves heat losses by radiation, conduction, and conviction, as well as the heat carried away by the oil leaving the bearing. Therefore, the numerical values obtained in any series of tests are dependent upon the heat-dissipation characteristics of the specific apparatus used. In the course of the bearing-research program, however, the operating conditions were such that it was possible to differentiate between the heat carried away by the oil and the heat losses through the apparatus itself.

These data show that under conditions typical of normal high-speed, high-temperature operation practically all of the heat generated in the bearing is carried away by the oil. Accordingly, the straight-line relationship between fluidity and pressure should hold reasonably well in most bearing applications. In these cases considerable information on bearing performance may be obtained by making a few observations of bearing temperature for various known operating conditions. This is of considerable significance since in many bearing installations friction measurements are not practicable.

Note: For further technical details of this work, see "Measurements of Combined Frictional and Therman Behavior in Journal-Bearing Lubrication," S. A. McKee, H. S. White, and J. F. Swindells, ASME **70,** *409, (1948).*

[1] These tests were part of a research program carried out with the cooperation and financial assistance of the National Advisory Committee for Aeronautics.

Plastic Coatings

■ CONTINUED FROM PAGE 176

baking coating on the interior and exterior of drill stems and well tubing and as vinyl resin coatings for the same purpose and including the coating of lease tanks, pumping lines, storage tanks and pumping stations and the run-down tanks after primary distillation in the refinery. As an example of the effectiveness in this case, in 1946 a well in West Texas was pulled 36 times due to tube failure. The tubing in this same well was coated with vinyl plastic coatings in July, 1947, and to the best of our knowledge the well is still in production without any subsequent failure. The main corrosive elements in sour crude production are hydrogen sulfide and salt water.

Water provides one of the tough corrosion problems; however, it is believed that the coating of drum gates, such as used on Grand Coulee, Fryant and Shasta Dams provide one of the toughest water corrosion problems. In this case the drum gates operate between piers. These piers have a milled steel surface on which a steel water seal from the drum gates operates. The problem is to prevent corrosion of the pier plate when subject to full immersion as well as when the drum gate is in its low position and the pier plate is subject to alternate wet and dry conditions.

Vinyl resin coatings were selected for this work because of their toughness and resistance to abrasion and high adhesion as well as their high resistance to water. The vinyl resin system applied to the pier plate at Grand Coulee Dam has been in service for more than five years without appreciable failure.

In the chemical field synthetic resin systems have been most extensively used. Here they have been used in coatings for such difficult exposures as ammonium nitrate storage tanks, coating for the interior of commercial hydrochloric acid storage tanks, a coating for caustic soda storage tanks with a 70 percent concentration of caustic at temperatures of 230° F., a coating for formaldehyde storage tanks, alcohol storage tanks, tannic acid tanks, molasses storage tanks, and many similar exposures.

In many cases there are records of vinyl coated storage tanks which have prevented both corrosion to the container and contamination to the contained liquid for periods of several years without any sign of failure. It is felt, therefore, that plastic coatings are providing a major tool for the prevention of corrosion in the major industries at the present time. Because they can be effectively specifically formulated, their effectiveness should increase materially.

REFERENCE

[1] Paints As Moisture Barriers. A. C. Elm, in Digest Federation of Paint and Varnish Production, April, 1947, p. 197.

Henry Nalepa threading casing at Pittsburgh Steel Company

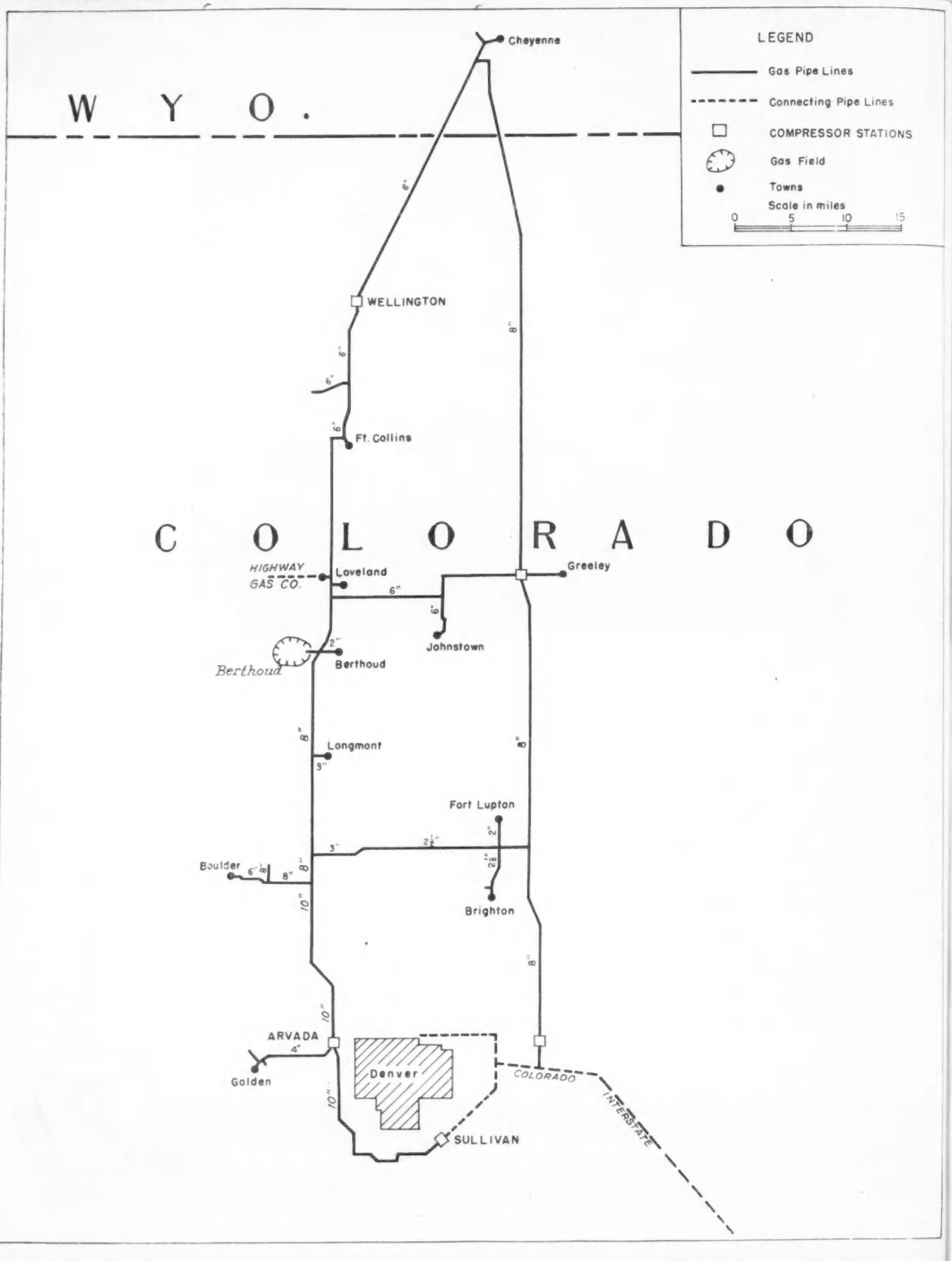
Pittsburgh Seamless oil country goods give you good reliable service year in and year out because of tradition—for example the tradition of making precision threads. As pioneers in precision threading Pittsburgh workmen aided by expert technical advice and up-to-date equipment have continued to lead in producing the best in seamless drill pipe, casing and tubing. This leadership is a moving force as we constantly seek ways to improve methods—so that we may better meet the requirements of the oil and gas industry. Pittsburgh Steel Company, 3268 Grant Building, Pittsburgh 30, Pa.

PITTSBURGH STEEL COMPANY

Pipe Lines of the U.S.

Colorado-Wyoming Gas Company

58th of a Series



SERVCO

Trade Mark

Non-magnetic "K" MONEL Collars

BRING THESE 4 ADVANTAGES to your Drilling Hook-ups

1. INCREASED SURVEY ACCURACY

Records are made in center of bore hole—free of magnetic effect of drill string. When located in "K" Monel collar, survey instruments are properly aligned with course of hole.

Surveys made in Servco collars indicate current trend of the hole because the record is made with the bit on the bottom.

2. SAVE RIG TIME

Servco "K" Monel drill collars provide for positive positioning of survey instrument. Save time lost in spudding and pick-up. No need for an extra round trip of sand line to pull a center bit.

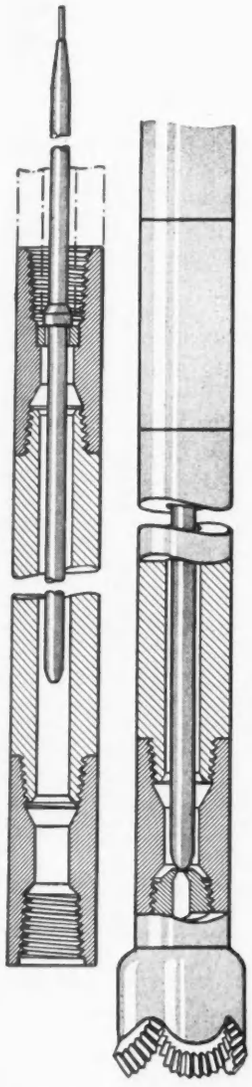
Survey instrument can be go-deviled, and retrieved with the drill pipe or with an overshot on wire line. While survey instrument is being go-deviled, Kelly can be made up, and rotation and circulation maintained until picture interval. Get survey records while retrieving center bit or core barrel.

3. HIGH PHYSICALS

"K" Monel gives you high physical properties: A yield point of 103,000 psi., tensile strength of 137,000 psi., elongation of 25% in 2", and Brinell Hardness (3000 Kg.) of 300.

4. REMAINS NON-MAGNETIC

"K" Monel remains non-magnetic at temperatures down to —100° C and does not become magnetic through cold working. Its maximum permeability is 1.02 compared with air which has a permeability of 1.00.



SURVEY INSTRUMENTS in recording position in Servco "K" Monel Drill Collar. (Left) Top landing. (Right) Landed on bit. Drawings and operating data, courtesy of Servco Corporation, Long Beach, Calif.

You can save time and money in directional drilling or straight hole control with *Servco* collars.

Designed for use in any drilling hook-up, they're made of "K"* Monel, a permanently non-magnetic nickel alloy with physical characteritics comparable to those of high grade steels.

"K" Monel collars help give you accurate recording. What's more, they eliminate the need of round-tripping pipe to get an open hole survey record. You run the collar immediately above your regular bit or reamer—run it right where it's in good position to show the latest trend of your drilled hole.

When you want a directional record, you simply run the survey instrument on a wire line, or go-devil it through the drill pipe to a fixed, positive seat inside the bore of the collar.

There's no problem. No running of specially designed bits so you can pass the survey instrument into open hole. (As you've probably discovered, special bits are likely to be more hazardous and less efficient than conventional types. And it's worth noting that "K" Monel collars come in all popular sizes, equipped with conventional tool joints. You can choose the bit for your job solely on its ability to *drill!*)

"K" Monel brings to Servco Drill Collars—as it does to so many other types of oil field equipment—continuous and reliable operation under conditions that rapidly weaken and destroy less rugged metals. In addition to being strong, tough and corrosion-resistant, "K" Monel has a magnetic permeability only slightly more than that of air. And it is not affected by increasing hole temperatures.

Complete information about *Servco* "K" Monel Drill Collars, including tables that give sizes and physical properties, are contained in a booklet offered you by the manufacturer. For your copy, write SERVCO CORPORATION, 904 Security Building, Long Beach 2, California.

THE INTERNATIONAL NICKEL COMPANY, INC.

67 Wall Street, New York 5, N.Y.

*Reg. U. S. Pat. Off.

EMBLEM OF SERVICE INCO TRADE MARK

"K" MONEL...YOUR PARTNER IN PROGRESS

PIPE LINE *Construction*

CONSTRUCTION on the largest natural gas pipe line system ever to be built is scheduled to begin early in 1949 under a contract that has the distinction of being the broadest agreement of its kind in the natural gas industry's history. A single contract covering the complete design, engineering and construction of Trans-Continental Gas Pipe Line Corporation's 1839-mile carrier from Southwest Texas to New York City has been awarded to The Fish Engineering Corporation, Houston.

Work is already under way. Control points along the route have been established and aerial surveys are being made. Ground surveys on particularly difficult sections have also been started.

The Trans-Continental system will have its origin in the Roger Lacy field, Hidalgo County, Texas, approximately 15 miles north of the Rio Grande River, and will follow the coastal plain along the Gulf of Mexico and the Atlantic Ocean to its terminus on the east bank of the Hudson River at 132nd Street, New York City. The general direction of the line's route will be easterly from Texas to Georgia and there start a northerly swing up the Seaboard. In addition to the main line, the system will require more than 400 miles of lateral lines for gathering supply gas and distributing sales gas.

The original application to the Federal Power Commission specified a 26-inch maximum pipe size, but that has since been amended and authority has been granted to increase the 1210-mile stretch between Opelousas, La., and Chester Junction, Penn., to 30 inches. This larger pipe will make necessary only ten compressor stations with an aggregate of 72,000 compressor horsepower, whereas 15 stations of 160,000 horsepower were originally planned. The proposed wintertime capacity of 340 million cubic feet per day was unchanged, but with the addition of nine compressors of 148,000 horsepower, daily capacity can be upped to 500 million cubic feet.

The main line will consist of 71 miles of 20-inch pipe, 558 miles of 26-inch and 1210 miles of 30-inch pipe. The Kaiser Company has contracted to furnish Trans-Continental with about 500,000 tons of steel plate over a period of approximately 24 months from its Fontana, Calif., mill. Consolidated Western Steel Corporation will fabricate the 26- and 30-inch main pipe line at its Maywood plant located near Los Angeles. The 20-inch main line pipe, six- to 16-inch lateral line pipe, river-crossing pipe and miscellaneous small sizes will be fabricated by A. O. Smith Corporation in Milwaukee.

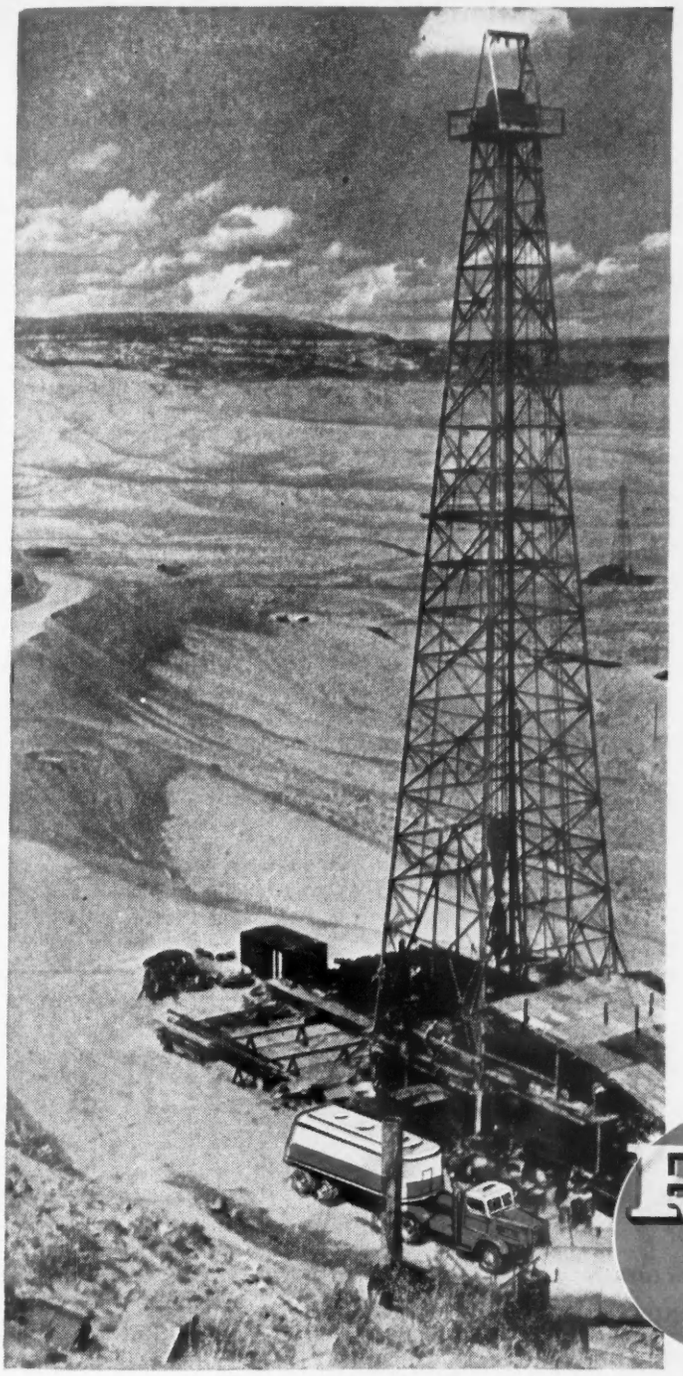
In authorizing the Trans-Continental system, FPC stipulated that actual construction be started within one year and completed within 28 months after the granting of the permit. The authorizing Certificate of Convenience and Necessity was issued in May, 1948. The contractor expects to start laying pipe in May, 1949, and have all facilities completed by the first of 1951, with the first delivery of gas at the eastern terminus by November, 1950.

Agreements for supplying gas at the eastern termination have been completed with nine large Pennsylvania, New York and New Jersey utility concerns, including Consolidated Edison Company of New York, Brooklyn Union Gas Company, Public Service Electric and Gas Company, Philadelphia Electric Company, and others.

Pipe Line Construction

Table includes projects planned, contracts awarded, and spreads or entire projects completed since the last issue of WORLD OIL

COMPANY	Origin and Terminus	Length (Miles)	Pipe Size (Inches)	Daily Capacity (Barrels Cu. Ft.)	REMARKS
CRUDE OIL LINES					
Interstate Oil Pipe Line Co.	Company's Magnolia station towards McKamie field, Ark	5	6		Section of experimental aluminum line to be built in sour crude area. Unlike the first which was laid bare, this is to be coated and placed in regular pipe line service Work started by company crews.
Oklahoma Natural Gas Co	Arkansas River crossing near Camp Gruber, Oklahoma				Started by Trojan Construction Co., Inc., Oklahoma City on 1st of December.
Phillips Petroleum Co	Gathering system in West Cement Medrano field, Okla	6⅔	4 & 6		Trojan Construction Co. Inc., Oklahoma City, completed in middle of December.
Shell Pipe Line Corp	Wasson station, West Texas to Hobbs station, New Mexico	32½	12		Smith Contracting Co., Ft. Worth, started work in early December.
Shell Pipe Line Corp., and the Texas Pipe Line Co. (Ozark Pipe Line System)	Cushing, Okla., refinery to Chelsea, Oklahoma	79	22		Pipe laying was started Dec. 8, by Midwestern Constructors, Inc., Tulsa. Spread includes Arkansas and and Cimarron River crossings.
Sohio Pipe Line Co	Take-up of Grayville, Illinois, district gathering lines	40	2, 3, 4,6		Somerville Construction Co., Ada, Michigan, will complete about middle of January.
Stanolind Pipe Line Co	Gathering lines in Fullerton field, Andrews County, West Texas	12	4, 6, 8		Completed in December by McVean & Roberts, Odessa Texas.
	Loop from Kellerville Jctn. to Center Station, Missouri Loop from Mill Creek Jctn. to Auburn Station, Missouri Loop from Orchard Farm Jctn. to West Bank of Mississippi River Jctn	60	12		Three loops on LaPlata to Wood River line being laid by Sheehan Pipe Line Co., Tulsa., and scheduled for Jan. 15, completion.
The Texas-New Mexico Pipe Line Co.	Shafter Lake Station, Andrews County, Texas, to tie into company's 8-inch line near Dollarhide field, West Texas	26	8		Contract awarded to Wright Construction Co., Lovington, New Mexico, and scheduled to start immediately.
SALT WATER DISPOSAL LINES					
Sun Oil Company	Brine disposal lines in Kimbell Lake field, Newaygo County, Michigan	5	3 & 4		Completed in December by Somerville Construction Co., Ada, Michigan.



FWD TRUCKS

ARE PART OF TODAY'S MODERN EQUIPMENT FOR LOCATING OIL WELLS AND CONSERVING THEIR PRODUCTION

The exploration, drilling and servicing of oil wells are scientific procedures which conserve a vital natural resource.

FWD four-wheel and six-wheel-drive motor trucks are "prime movers" of heavy equipment in all of these vital operations.

With driving power on all wheels FWD trucks haul heavy loads with surety and safety on the highway or across open country over terrain impassable to conventional trucks. FWDs rank foremost in oil field operations as they do in many other fields of heavy-duty truck service.

THE FOUR WHEEL DRIVE AUTO CO.
CLINTONVILLE, WISCONSIN
Canadian Factory: KITCHENER, ONTARIO

America's Foremost Heavy-Duty Truck

The M6 x 6 FWD trucks pictured here are hauling bulk cement to location — heavy loads, on long hauls, over difficult terrain.

Pipe Line Construction—Continued

Table includes projects planned, contracts awarded, and spreads or entire projects completed since the last issue of WORLD OIL

COMPANY	Origin and Terminus	Length (Miles)	Pipe Size (Inches)	Daily Capacity (Barrels Cu. Ft.)	REMARKS
PRODUCTS LINES					
Alamo Refining Company	Sweeny refinery to Freeport, Texas Gulf Coast	24	8	.....	Work started by Latex Construction Co., Houston.
Petroleos Mexicanos	Minatitlan refinery, Veracruz, to Salina Cruz, State of Oaxaca, Mexico	155	8	.....	To cross Isthmus of Tehuantepec to a terminal on Pacific Ocean side. Job will probably be let to private contractors by Pemex.
Socony-Vacuum Oil Company	Portland terminal to Hallowell, near Augusta, Maine	61	6	11,500	Completed in December by Associated Contractors & Engineers, Inc., Houston.
	Hallowell to Bangot, Maine	66	4		
	Malvern, Pennsylvania to Binghamton, New York	155	8	18,000	Mainline and branch completed by Midwestern Constructors, Inc., Tulsa., in December.
	Branch from mainline to Allentown, Penna., bulk terminal	7	6	.....	
NATURAL GAS LINES					
Empire Southern Gas Company	Gathering systems in Shafter Lake gas field, Andrews County, and Kirk field, Comanche County, Texas	5	2 & 4	11 mln	Four miles of 2 & 4-inch completed by Curtis Bros. Construction Co., Andrews, Tex. and one mile 4-inch by company crew in Kirk field.
Illinois Northern Utilities Co	Company's Oregon, Ill., regulating station to Natural Gas Pipe Line Co. of America's meter station	9	4	.....	Midwestern Contractors, Inc., is scheduled to complete in January.
Michigan Gas Storage Company	Panhandle Eastern Pipe Line Co's Chelsea, Mich. Terminal to Winterfield and Cranberry Lake gas storage fields, Mich.	150	24	.....	Contracts to be let soon for early construction.
Oklahoma Natural Gas Company	Holdenville, Oklahoma to Maysville, Oklahoma	70	16	.....	Both lines completed by Trojan Construction Co., Oklahoma City.
	Vicinity of Muskogee, Oklahoma	10	18	.....	
Southern Natural Gas Company	Loop near Birmingham, Alabama	35	24	.....	Completing by H. C. Price Co., Bartlesville, Oklahoma.
	Loop in Eastern Alabama and Georgia	70	24	.....	Job completed by Latex Construction Co., Houston, except Coosa River crossing which has been delayed by pipe arrival and floods.
Stanolind Oil & Gas Company	Gathering system in Slaughter field, near Sundown, West Texas	320	2 to 30	.....	Being completed by Deaton & Sons Pipe Line Construction Co., Odessa, Texas.
United Gas Pipe Line Company	Mineola to Lindale, Texas	15	6	.....	Completed in December by Bishop & Lock Construction Co., Dallas.
	Near Orange, Texas, to TET Corp. 8-inch line north of Orange	3½	10 & 12	.....	O. C. Whitaker Company, Ft. Worth, has contract.
Warren Petroleum Corp.	Gathering system to serve Lindsey, Okla., gasoline plant	65	2 to 30	.....	Pipe Line Service Co., Seminole, Oklahoma, completing.

Empire Trust Company

NEW YORK

Capital Funds .....$ 8,915,863.61
Total Resources 128,880,113.35

Directors

DEAN MATHEY
Chairman of the Board

FRANK V. BALDWIN
Retired

C. KENNETH BAXTER
Chairman of the Board
Deep Rock Oil Company

JOHN T. CAHILL
Cahill, Gordon, Zachry & Reindel

EVERETTE L. DeGOLYER
DeGolyer & MacNaughton
Dallas, Texas

GEORGE A. EASLEY
Vice President, Salt Dome Oil Corp.

DEAN S. EDMONDS
Pennie, Edmonds, Morton & Barrows

CHARLES S. GARLAND
Alex, Brown & Sons
Baltimore, Maryland

ARCHIBALD A. GULICK
Alexander & Green

PAUL H. HUDSON
Executive Vice President and Secretary

JOHN L. LOEB, Partner
Carl M. Loeb, Rhoades & Co.

GRAHAM D. MATTISON
Dominick & Dominick
New York

HENRY C. BRUNIE
President

DONALD H. McLAUGHLIN
President, Homestake Mining Co.

JULIAN S. MYRICK
Vice President, Mutual Life Insurance Co.

CLENDENIN J. RYAN
President, Big Horn Cattle Co. of Colorado

ARTHUR A. SEELIGSON
President, Transwestern Royalty Co.
San Antonio, Texas

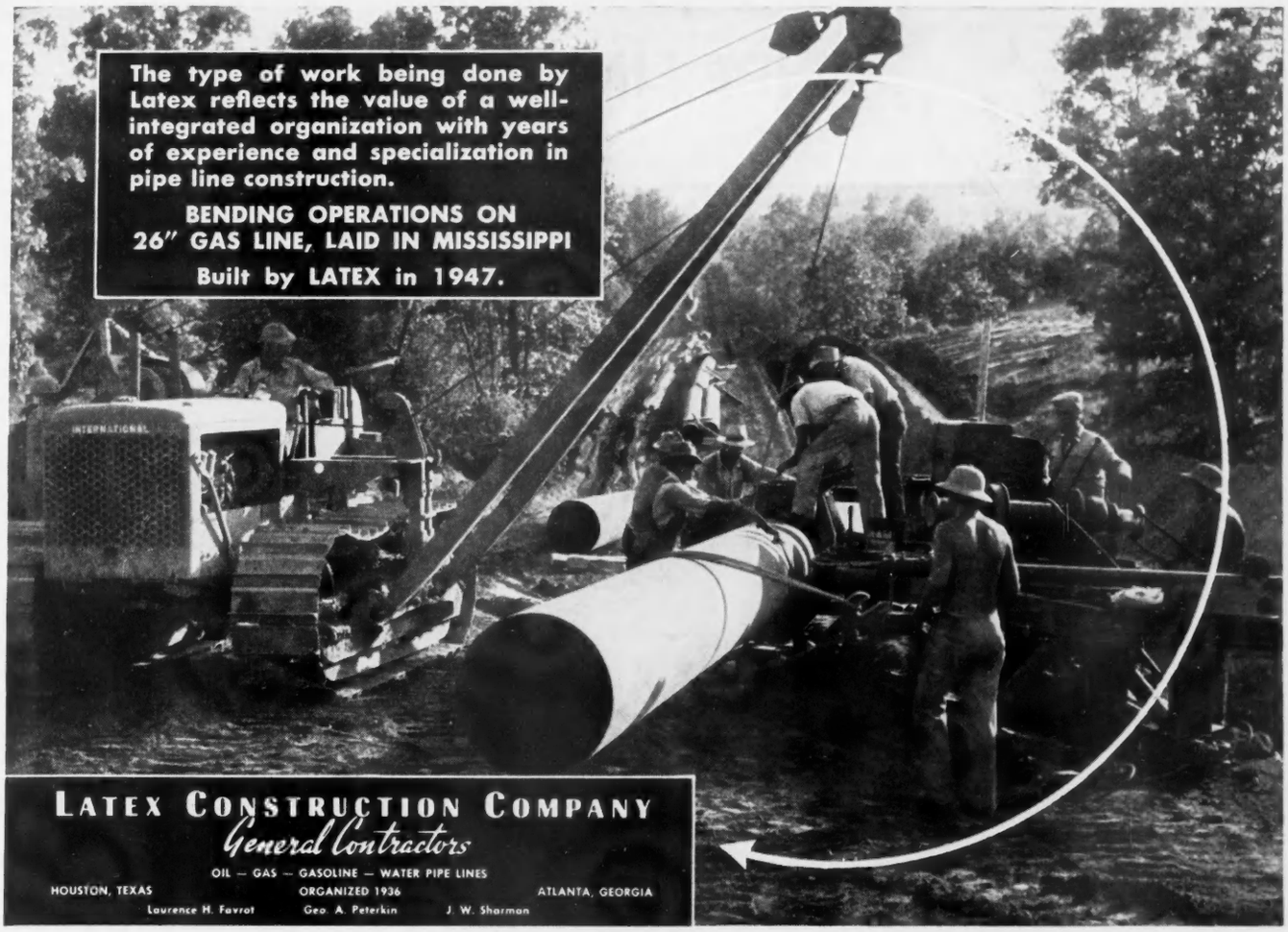
JAMES H. VAN ALEN
Vice President, Farrar, Straus & Co., Inc.

Specialized experience is available for study and suggestions as to sound financing of oil properties.

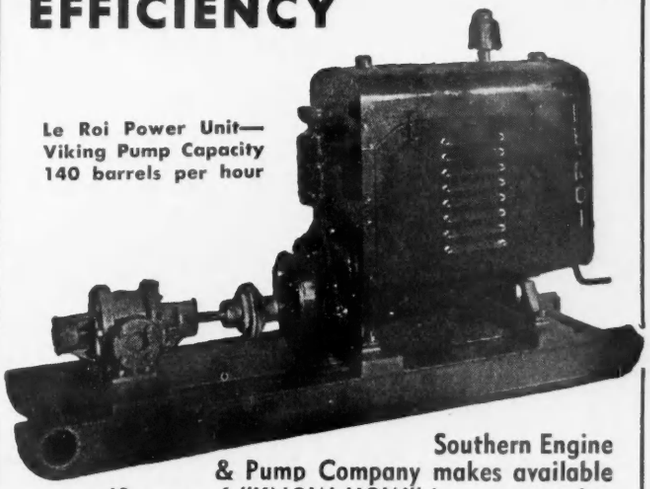
Main Office
120 BROADWAY, NEW YORK

Fifth Avenue Office
580 FIFTH AVENUE

MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION


The type of work being done by Latex reflects the value of a well-integrated organization with years of experience and specialization in pipe line construction.
BENDING OPERATIONS ON 26" GAS LINE, LAID IN MISSISSIPPI
Built by LATEX in 1947.
LATEX CONSTRUCTION COMPANY
General Contractors
OIL — GAS — GASOLINE — WATER PIPE LINES
HOUSTON, TEXAS
ORGANIZED 1936
ATLANTA, GEORGIA
Laurence H. Favrot
Geo. A. Peterkin
J. W. Sharman

THE RIGHT TEAM FOR EFFICIENCY



Le Roi Power Unit—
Viking Pump Capacity
140 barrels per hour

Southern Engine & Pump Company makes available to you 40 years of "KNOW HOW" in your pumping requirements.

• Complete units and replacement parts at all branches.

SOUTHERN ENGINE & PUMP COMPANY

MANUFACTURERS • MACHINERY FACTORS • CONTRACTORS

Houston - Dallas - Kilgore - San Antonio
Edinburg - Lafayette, La.

"I'll take the WHITE one every time!"

WYTEFACE "A"
Trade Mark
Steel Tapes for the Oil Industry

WYTEFACE "A" Steel Tapes have raised black graduations on a crack-proof white surface. Easy to read in any light, from any angle. Designed for hard service. Resist rust and corrosion. Raised rims and markings protect the white background from abrasion from rails, pipe, rocks, concrete. Made in styles especially for Oil Riggers, Oil Gaugers and for general measurements. See your supply house, or write for details to Keuffel & Esser Co., Hoboken, New Jersey.

K+E
Drafting, Reproduction, Surveying Equipment and Materials, Slide Rules, Measuring Tapes.

KEUFFEL & ESSER CO.
EST. 1867
NEW YORK • HOBOKEN, N. J.
Chicago • Detroit • Los Angeles
St. Louis • San Francisco • Montreal

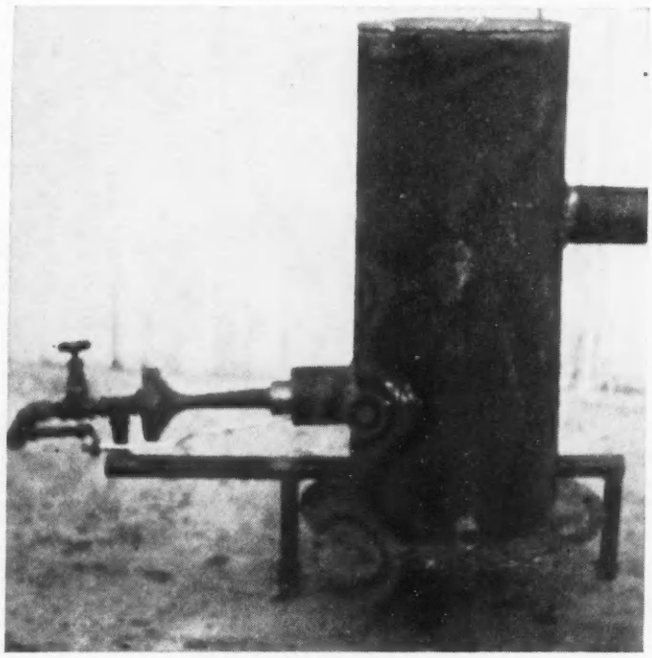
How to do it!

PIPE LINE HINTS

$10 is paid for each illustrated acceptable contribution. Mail to The Editor, WORLD OIL, P. O. Box 2608, Houston 1, Texas

HOW TO—Construct Field Office Stove with Salvaged Piping

For heating the field office, during the winter season, one operating pipe line company which had access to plenty of natural gas, had welders construct a simple stove from odd pieces of piping material.



Body or shell of the stove was a piece of 12¾-inch line pipe, 28 inches long. A disk of thin flat steel was cut to size and welded across its upper end. A 3-inch hole was cut in the side of the shell 12 inches from the top. Over this hole the end of a 4-inch length of 3-inch pipe was welded. This projecting piece of 3-inch pipe serves the purpose of a sleeve for joining the venting stove pipe to the stove shell.

On the opposite side of the shell six inches up from the bottom rim, another 3-inch hole was cut, and the end of a short length of 3-inch pipe welded, to serve as an entrance for the end of the gas burner and the flame end of the pilot lighter tube.

Directly under and in line with the burner entrance, a supporting arm for the burner was made by welding a 12-inch length of 1-inch pipe to the outer surface of the shell, so that it projects outward. To the outer end of this projecting piece of 1-inch pipe, one end of a ½-inch pipe nipple two inches long was welded, so that the threaded end points upward. The intake of the gas burner was screwed into the end of the Tee pointing toward the burner entrance in the shell.

The threaded end of a short ½-inch pipe nipple, to which a controlling valve was attached, was screwed into the outer opening of the Tee. Projecting supports for the stove legs were made from 4-inch lengths of 1-inch pipe. To the bottom end of each of the legs, a threaded pipe cap was screwed. Leveling of the stove is accomplished by tightening or loosening the caps on the ends of the legs.

An 18-inch disk of thin, flat steel was tack welded to the inner edges of the legs, at a distance of two inches below the bottom rim of the stove shell. This plate tends to keep the floor area directly under the stove shell from becoming excessively hot. The space between the heat reflecting plate and the bottom rim of the shell permits the entrance of secondary air into the burner chamber for supporting combustion. Such a stove is simple and inexpensive to construct. Since the burner flame is entirely enclosed by the stove shell, fire hazard is brought to a minimum,

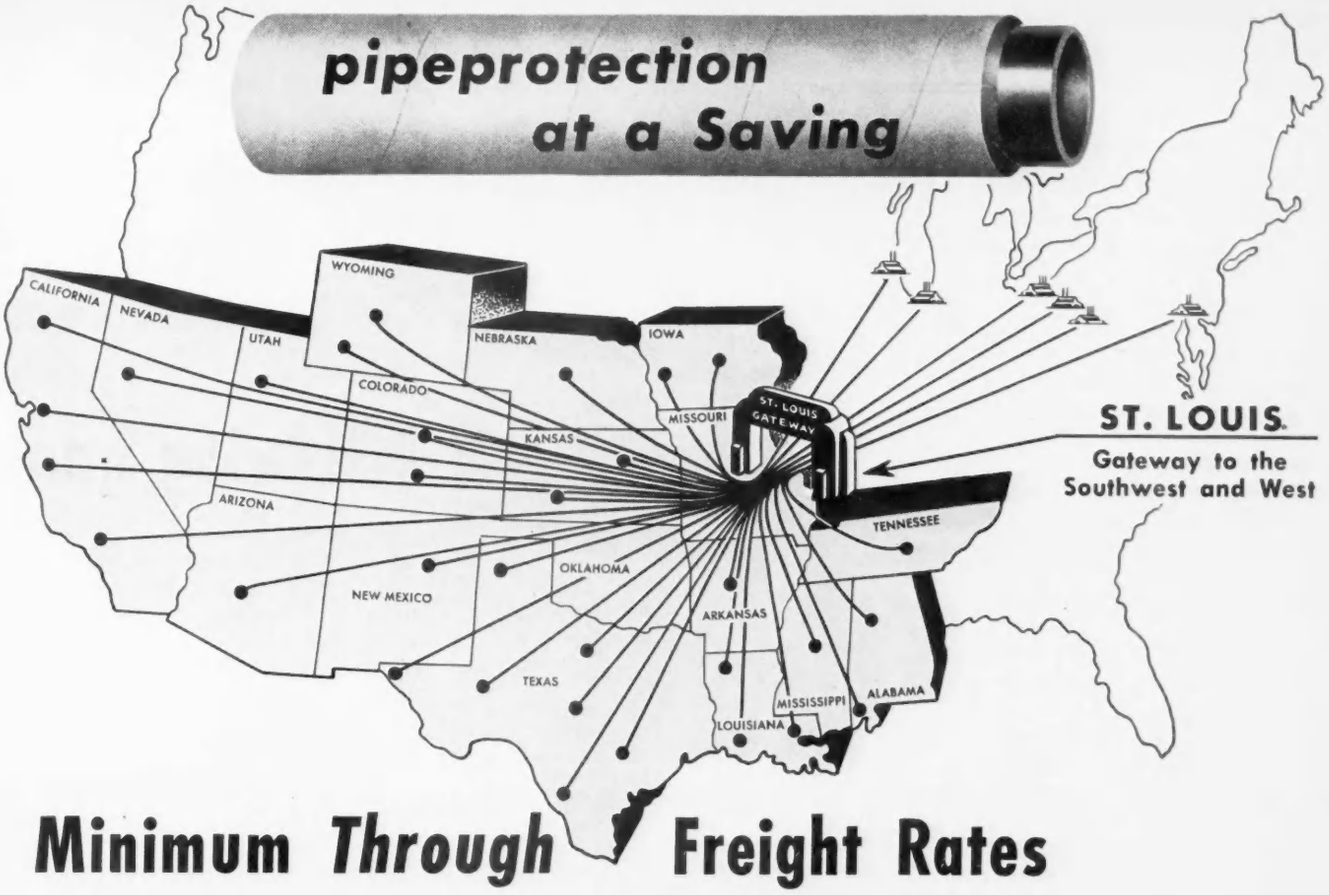
HOW TO—Save Electrician's Time with Tank Farm Storage Bins

To reduce the number of trips which the tank farm electrician must make back to the warehouse for supplies, a pipe line company provides storage bins at convenient points in which are stored the supplies most frequently used in repair or maintenance of the farm's electrical systems for lighting and gauging.

The bin is made up from sheet steel, with a hinged front door which opens downward to give access to storage shelves. The top of the door is fitted with a semi-circular rim which acts as a drain to carry away water running down the front of the bin and which also acts as a stiffener to protect the door against distortion when opened.

The entire top of the bin is hinged at the back, and is flanged on three sides for weather protection. A counterweight at the back of the top is carried on three brackets attached to stiffeners in the top, and makes the unit easy to open or close by one man. The top section under the hinged cover provides segregated storage for numerous small parts and thus assists in quick selection of materials needed.

pipeprotection at a Saving



ST. LOUIS
Gateway to the Southwest and West

Minimum *Through* Freight Rates with "In-Transit Privileges" at St. Louis

. . . standard pipeprotection, inc. . . . offers two outstanding advantages to purchasers of pipe

1 When you ship through the St. Louis gateway you use "through freight rates" instead of the higher combination rates generally used. This in-transit privilege permits stop-off for processing or storage up to 12 months at St. Louis without freight penalty.

2 Your pipe is cleaned, coated and wrapped to your own specifications by modern streamlined methods. Our plant and facilities (covering 22 acres) represent the last word in pipe handling equipment. The techniques used are the best practices that have been developed through experience by the industry.

From start to finish, the manufacturing process is controlled by standard procedures. This guarantees new standards of protection — new records in performance—important considerations these days to every buyer of pipe.

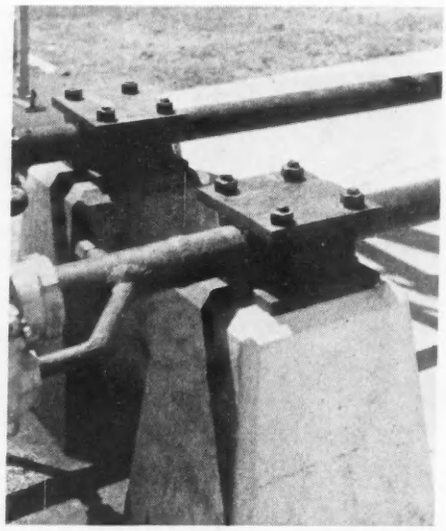
standard pipeprotection, inc.

3000 South Brentwood Boulevard
St. Louis 17, Missouri

Our plant, handling the smaller diameters of pipe, is now in operation. For full information about schedules write today.

HOW TO—Fabricate Effective Clamp for High-Pressure Lines

In certain high-pressure installations where it is absolutely essential that high pressure field lines should not vibrate or be allowed to expand or contract except at expansion joints or loops so provided, a Wyoming operator makes use of an unusually effective yet simple line clamp. Prefabricated in the shop, the clamp consists of two square pieces of steel plate, dimensions varying according to the size of pipe to be clamped. To each piece of plate is welded a half section of pipe, the latter having an inside diameter approximately equal to the outside diameter of the line. Bolt holes are drilled through the four corners of the matching plates. When the supporting blocks or piers are poured, long studs having threads for their entire exposed length are set in the concrete. When the line is installed, one-half of the clamp is dropped over the studs and nuts are run down to securely anchor that half of the pier. The top half then is placed atop the line and another set of nuts run down to the desired degree of tightness to hold the line rigidly in place. The clamp is easily tightened from time to time, and with the exception of the studs, the entire clamp is entirely salvageable whenever the line is taken up.



HOW TO—Build Locking System

An ingenious device which locks simultaneously all drawers and bins on the side of their field department service truck is employed by a major oil company. The only visible part of the locking system is a short horizontal handle attached to a vertical shaft, the latter projecting through the overhead of the compartmented section as shown. Operation of the lever actuates within the enclosure a series of horizontal rods, each mounted immediately in back of a row of drawers. Welded to these rods

at intervals are short steel bars, the latter so positioned that upon actuating the outside handle, they will engage loops welded to the back side of the drawers, each drawer thereby being locked in a tightly closed position. A single padlock is run through a steel pin chained to the device, the pin being run through matching lugs as shown.

The fact that the entire section can be so quickly locked, and no drawers can be left open accidentally with resultant possible loss by theft of valuable tools and fittings, make the additional expenditure amply worth while on a field supply unit of this type.

PIPE!

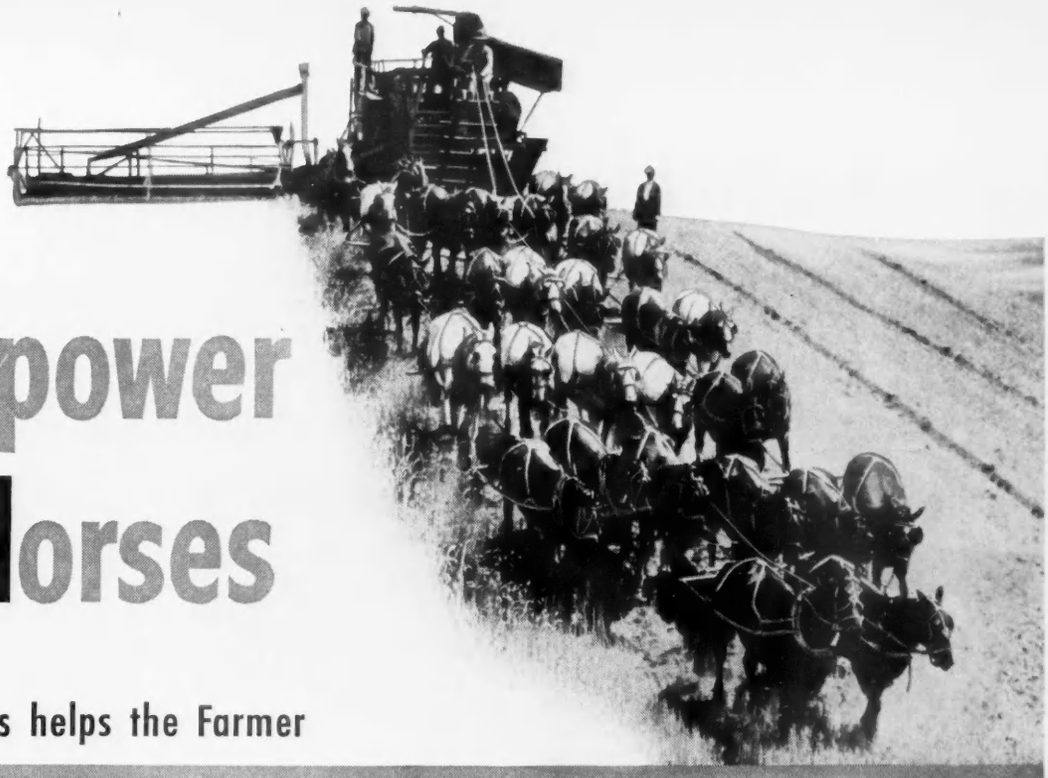
SPOT DELIVERY! F.O.B. OUR YARDS, LULING, TEXAS

- 5½ inch Lapweld Casing. No. 1 used.
- 2 inch Wrought Iron and Steel Tubing Excellent for line pipe. A-1 condition.
- 3 inch Seamless Tubing. One run. Long Collars. Range 2.
- 8⅝ inch and 10¾ inch Lapweld and Seamless Surface Pipe.

Complete stock of sizes for water well drillers. We can deliver immediately in string or carload quantities most all standard sizes of casing and tubing.

Write, Wire or Phone

RIDDLE
PIPE & SUPPLY CO.
BOX 942 • SEGUIN, TEXAS • PHONE L.D. 1



Horsepower without Horses

Petroleum Progress helps the Farmer

DOBBIN yields to the tractor to increase farm food production. Last year America's farmers used over 3 billion gallons of tractor fuel alone, not counting fuels for trucks and other equipment.

Many farm products are used *by* the petroleum industry . . . 20 million pounds of beef tallow annually for steam locomotive driving rod and axle grease alone . . . also lumber, fibre, paint materials, leather and other products. A chemical derived from oat hulls and corn cobs is extensively used in a Texaco method of refining lubricating oils.

Texaco representatives in all 48 states help farmers with their lubrication problems.

• In the farm field Texaco research and engineering have provided, (1) quality fuels and lubricants for automotive equipment, (2) quality lubricants for farm machinery, (3) rustproof compounds to protect against deterioration of equipment, (4) a nation-wide educational program to enable farmers to get the most out of farm machinery in every type of farming.

THE TEXAS COMPANY

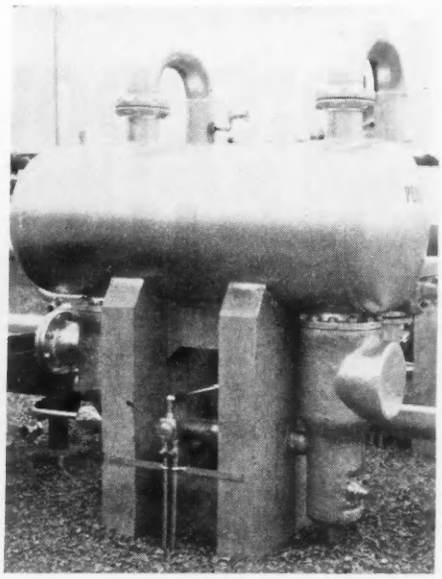
Petroleum Promotes Progress

TEXACO REG. T.M.

HOW TO—Heat Water Leg in Line Separator to Prevent Freezing

During cold weather, the water drained from the throughput of a products line can offer a hazard to equipment through freezing and blocking passages or even rupturing the equipment. On one products system, the separators at the various stations are equipped with drop legs in which the water and sediment collect, each being fitted with a drain for removal of the trapped fluids.

The drop legs are wound with several turns of lead-armored low-resistance heating wire, which in turn is connected to a thermostat which controls flow of current through the resistor. When temperature drops to the dangerous range, the heater goes into operation, and the water is heated to a degree which will insure its flowing readily into the drain system when the automatic fluid regulator functions.



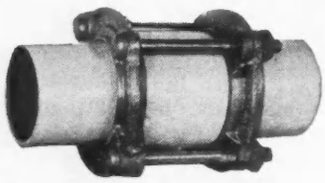
Drop leg and resistance wire are enclosed in a heavy coating of insulation, so as to conserve heat and insure even distribution of the warming effect of the coils when activated with current.

STOP LEAKS FAST

in any weather . . . on any pipe . . .

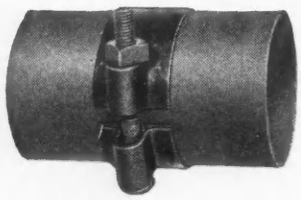
. . . Without shutting down the line. Just put a Dresser Repair Clamp around the leaking pipe—draw up the bolts—and in a matter of minutes, you've made a bottle-tight repair.

The four styles shown here are just part of Dresser's complete line of repair products. See them at your oilfield supply store or write for our Oilfield Catalog. Overnight delivery throughout the southwest from our Houston warehouse. Keep Dressers in stock and have the jump on emergencies.



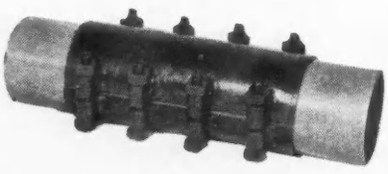
COLLAR CLAMP

Styles 4 and 41, for repairing and preventing leaks through threads of screw collars.



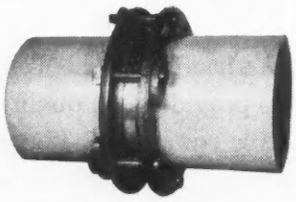
BAND CLAMP

Style 77B, for repairing small leaks and holes in the run of pipe.



SPLIT REPAIR CLAMP

Style 79B, for repairing pitholes and longitudinal splits in pipe.



POROUS-WELD CLAMP

Style 55, for repairing circumferential weld leaks.

DRESSER REPAIR CLAMPS

ONE OF THE DRESSER INDUSTRIES

Dresser Manufacturing Div., 59 Fisher Ave., Bradford, Pa.
Houston Warehouse, 1121 Rothwell St., Houston, Texas

HOW TO—Support Pipe Lines

At a tank farm where the soil is exceptionally corrosive, one company supports service lines above the ground with short four-legged "derricks." These supporting units are made in the pipe line shop from two-inch pipe which was salvaged from other service.

Each support has four legs attached to square steel pads which rest upon the ground. The legs are brought together at the top and welded to a heavy plate substantial enough to carry the pipe line load. An eye bolt passed through a hole in this crown plate is

How you REDUCE DOWN TIME

by hauling with WALTER TRACTOR TRUCKS

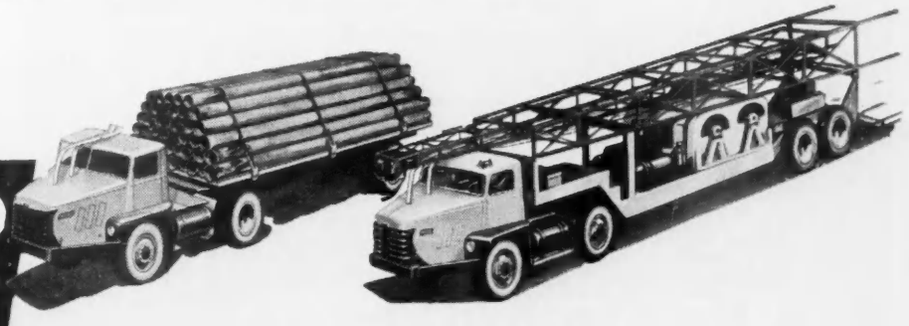
HOW much unproductive time do your rigs and equipment now waste through delays and difficulties in hauling? Every hour—every day you can save, is money earned.

Walter Tractor Trucks can save many days and service more jobs for you during the year. They are especially designed and engineered for off-the-road hauling of huge loads. They are far less affected by changing terrain, bad weather and grades that slow down or stop other trucks.

Walter Tractor Trucks move your loads fast and unfailingly under all conditions—adding working days to your calendar that are now lost because running conditions make hauling impossible.

How can Walter Tractor Trucks do this? Briefly, because of their tremendous power and 100% traction in all four driving wheels—produced by the exclusive 4-Point Positive Drive. This great feature, plus many other engineering advances, has put Walter Tractor Trucks in a class by themselves in severe off-the-road hauling, for over 25 years.

Write for descriptive literature explaining the many advantages of Walter Tractor Trucks for your hauling.



WALTER
4-POINT POSITIVE DRIVE
TRACTOR TRUCKS

WALTER MOTOR TRUCK CO. 1001-19 Irving Ave. Ridgewood 27, Queens, L. I., N. Y.

attached to a short piece of wire line, which in turn is connected to a band around the pipe which was jacked up to the height for a connection.

Purpose of the wire line and eye bolts is to permit free movement of

the line caused by expansion and contraction. The supports are of sufficient height so vegetation can be kept under control, and as the pipe lines do not touch the ground, soil corrosion is prevented and the wrapping or insulation does not deteriorate.

HOW TO—

Anchor Pipe Lines

On small pipe lines or tank farm gathering lines where very little or no vibration or movement can be permitted because of possible damage to fittings on nearby tanks or pressure vessels, one company finds it economical to employ a simplified anchoring system that requires very little time and materials. At the desired intervals, the line is supported on vertical posts cut from salvaged pipe, and to the sides of each of the posts are welded short threaded ½-inch studs or bolts, the latter being bent and installed in the manner illustrated.

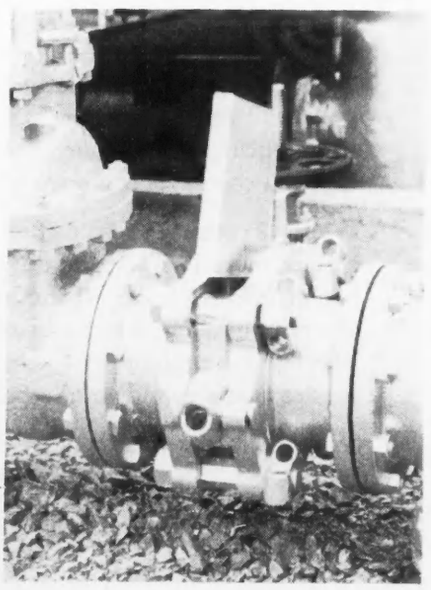
Matching the bolts, and welded to the sides of the pipe line are short nipples of ½- or ¾-inch pipe. Pulled down with nuts on both sides, the light clamps hold the line rigidly. Because there is very little advance preparation necessary for installation of this type of clamp, it may be installed easily in the field. Exact placement of the short nipples is possible inasmuch as the previously welded bolt on the support determines its location.

HOW TO—

Protect Line Blinds

To protect the unused portion of a spectacle blind from dust, rain and possible impact, one pipe line company provides each installation with a square box or shield just large enough to slip readily over the exposed section of the blind, and closed on all sides except the bottom.

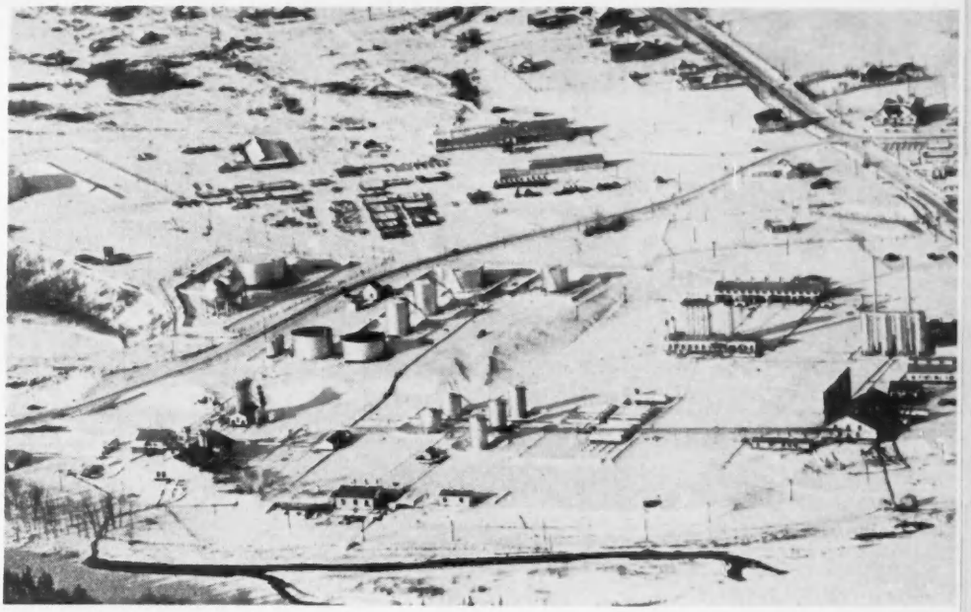
The cover, painted aluminum as are



all other exposed areas of the pipe line, is thoroughly protected against rusting and, by shielding the blind within it, greatly reduces the corrosion evident on that member. Sides of the box are made long enough to cover the entire seating area of the blind, and thus to insure against the contact of the seat with any windblown dust or dirt.

Each blind, at the time of installation, is equipped with the special cover, and care is taken to see that the cover is in place at all times on which every portion of the device, blind or orifice plate, is outside the flanges.

Gotkool
WATER CANS
& COOLERS
Gott
WATER CAN
GOTKOOL WATER CAN
Made in 1½, 2, 3, 5, 10, 15 and 20 gallon sizes. (Push-Button Faucet at slight additional cost.)
GOTT Water Cans are the practical way to keep drinking water cool for long periods, protected from impurities and always handy to the job. Snug fitting large removable top, strongly built to withstand rough usage. GOTT Water Coolers have extra large covers and a handy non-leaking push button faucet. Your Supply Store has them, get one today! . . . . . .
GOTT
GOTKOOL WATER COOLER
Made in 2, 3, 5, 8, 10, 15 and 20 gallon sizes with Push-Button Faucet.
H. P. GOTT MFG. CO.
WINFIELD, KANSAS
KEEP PURE DRINKING WATER ALWAYS HANDY



Interesting Turner Valley

Water Flood Experiment

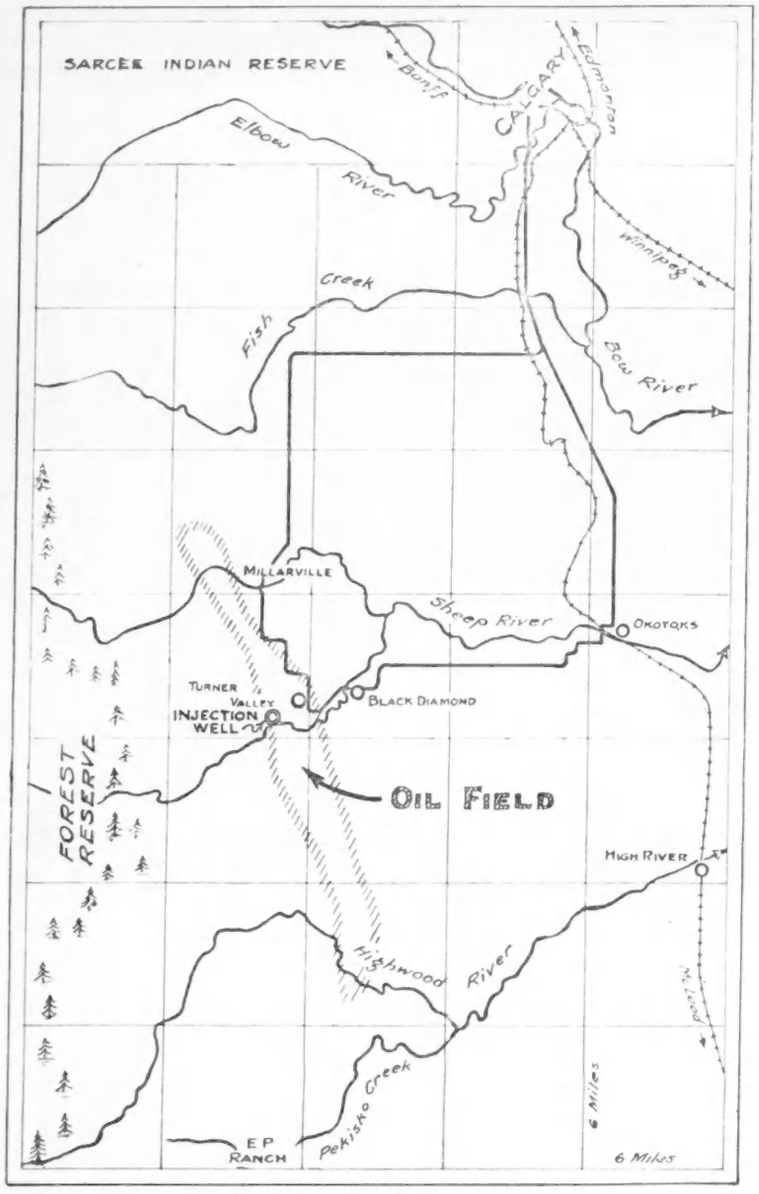
AS THE Turner Valley field nears the point where recovery of oil by primary producing methods will show a progressively greater decline, the operators have been devoting considerable research to possibility of instituting an efficient secondary recovery program. Waterflooding was started in August, 1948, in a portion of the field thought suitable. Engineers of Royalite, in collaboration with other operators, are trying several new procedures which it is hoped will increase the efficiency of the project, one of which involves heating input water to the same temperature as the formation. Although most of the field's production comes from one formation, it is hoped that a relatively impermeable barrier existing in the middle of the structure will serve to control migration of the input water.

ROYALITE Oil Company, Ltd., of Calgary, principal producer in the Turner Valley field of southern Alberta, Canada, is well started on a secondary recovery experiment under conditions not exactly duplicated elsewhere in the world, so far as is known. Certain methods will be tested, such as heating the input water to conform to the temperature of the formation into which it is being injected.

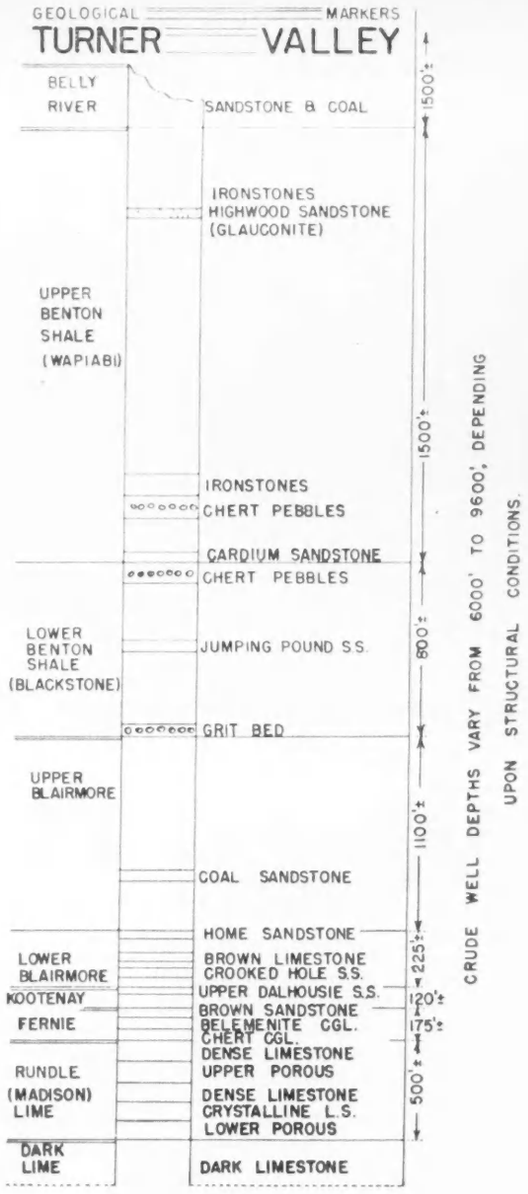
The Turner Valley field, until overshadowed by recent developments at Leduc, Redwater, and Pincher Creek, was the largest oil field in the British Empire. It is about 25 miles long, from northwest to southeast, and varies from one-half mile to about three miles in width. In mid-October it contained 394 wells, of which 91 were classified as gas wells producing 30,000 cubic feet or more of gas for each barrel of oil, and 303 were capable of producing oil in ratios of one barrel per 30,000 cubic feet of gas or less. The area of the gas cap, which roughly embraces the eastern half of the long narrow field comprises approximately 8100 acres, and the downflank areas yielding oil total approximately 17,000 acres. The original oil-content of the reservoir has been estimated at 750 million to 1 billion barrels, of which around 80 million barrels—or 10 percent—have been recovered to date. It has been estimated that primary methods of recovery might yield as much as 110 million barrels. Production comes chiefly from the Madison Lime, at depths ranging from 4000 to 9000 feet which has a porosity of 8 to 10 percent, based on examination of cuttings, findings which are not accepted as conclusive pending further analysis of diamond cores.

Core recovery by conventional methods has proven difficult, up to now; but such cores as have been recovered and examined showed a displacement efficiency of 79 to 92 percent. The drive is from dissolved gas.

The producing lime is not uniformly permeable, and fear of channelling represents the chief hazard of the experiment now under way. The pay zones in the north and south ends of the field are disturbed by faulting; but the center section, selected for the experiment in water-flooding, is relatively free of such disturbance. Fortunately, also, there is less permeable zone in the Madison Lime. This zone is approximately in the geographic center of the long, narrow oil-producing section of the field and forms a line running along the axis of the field which delimits oil production on the east. It might be said that this less permeable zone is about seven miles long, running from northwest to southeast and dividing the field approximately in half, with oil wells on the west and gas wells on the east. It is hoped that



Location of Turner Valley input well.



this relatively impermeable zone will serve as a barrier to limit or contain the migration of water, which is being injected at a point on the west or down flank of the oil-producing area, near the center of the field as measured from northwest to southeast, and two miles southwest of the town of Turner Valley.

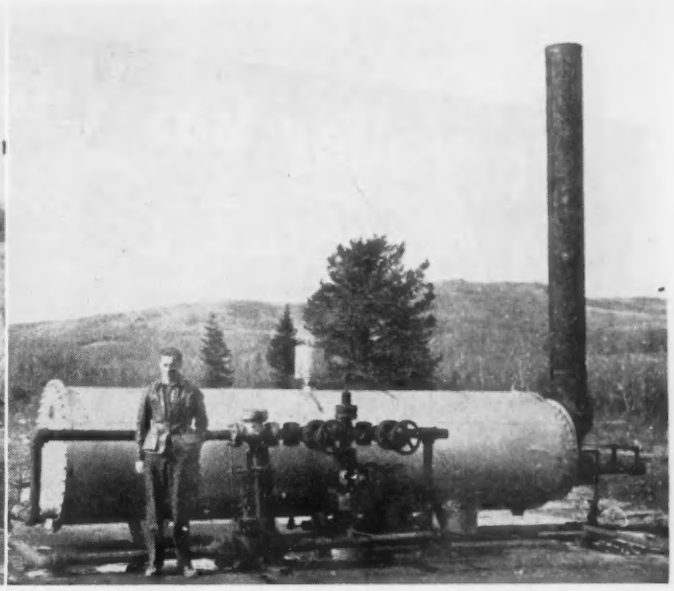
Royalite 75 was selected as the input well for the initial phase of the experiment; for technical reasons, as it is on the down flank of the field, in a zone not disturbed by faulting, and is protected by the impermeable, or less permeable, barrier described above; and for practical reasons, since it is in an area where acreage is largely controlled by the company financing the test and by independent producers willing to cooperate. The input well has about 90 feet of porous pay lime, capped by about 130 feet of dense lime, at a total depth of 8537 feet.

First step in the execution of this experiment was the employment of a water well contractor to find a suitable, and adequate water supply. This was necessary despite the location of the experiment almost on the bank of Sheep River. The river water was considered unsuitable for injection, since it contains too much dissolved oxygen which might have promoted oxidation in the tubing. Water with a pH factor nearly suitable was found at 112 feet in a well drilled about one-half mile away. However, it was considered advisable to treat this well-water with hydrochloric acid in order to lower its pH factor from 7.7 to 6.6, so as to minimize the precipitation of calcium carbonate which might have served to clog the pores of the lime formation into which it is being injected. The water supply well is equipped with a deep well turbine pump, with a 15-horsepower electric motor at the surface connected by a long driveshaft with impellers at the bottom. It is capable of yielding up to 6000 barrels of water per day.

The injection of water was started on a preliminary basis August 6, 1948, using such equipment as was readily available, consisting of a 125-horsepower diesel engine and 3½ x 10-inch pump. Injection is through three-inch tubing at a current rate of 2000 barrels per day at a working pressure of 1100 pounds per square inch. As of the middle of October, only about 122,000 barrels of water had been pumped into the formation. After calculating the volumes of oil and gas previously removed from this section of the reservoir, engineers in charge estimate that some results indicating the progress of the experiment may be expected after approximately 600,000 barrels of water have been injected.

The next step in the plan of the project, and one which has not been tried elsewhere, will be to heat the input water to lower its viscosity and so that it will enter the lime reservoir at a temperature approximating that of the formation itself, which has been ascer-

Water injection equipment consists of a 125-horsepower diesel engine and a 3½ x 10 inch pump.



Heater employed to heat injected water. Gordon Connell, petroleum engineer for Royalite Oil Company, in foreground.

tained as 150° F. To heat the injected water, which comes from the ground at a temperature of 41° F. and is now entering the formation at approximately 80° F., or 70 less than that of the formation, an indirect type heater has been installed. Two or more such heaters may be added later, if required to increase and maintain the desired schedule of injection.

This heating of the injected water may serve to decrease its viscosity by about 50 percent and, if so, to double the rate of input.

If success is indicated, the experiment eventually will be converted to a permanent basis by the installation of larger high-pressure pumps, power plant, heaters, etc. A working pressure of 2000 pounds per square inch will be sought, with a rate injection approaching the output capacity of the water-supply well, or 6000 barrels per day, as stated above.

Meanwhile, the search for other wells yielding water which is suitable, or which can be made suitable, for injection is being carried out in other parts of the field, so that water may be available in event the success of this experiment should indicate the desirability of the injection of water in other areas of the field. The success of this enterprise may indicate the advisability of drilling additional new wells up flank in the oil zone, to recover the oil which is expected to be driven in that direction.

Operators interested in the future of the field are dividing their attention between the experiment in secondary recovery on the west flank of the field, and the progress of deep drilling now under way to develop a lower block of porous limestone. This is thought to be a fold of the Madison Lime, principal paying formation of the field, which was found to be productive of oil in substantial quantities in the deepening of Royalite 73. The heavy rotary rig used in this deepening operation was moved to Royalite 72, where deepening is now under way; and another rig is at work on a new well at an outpost location, where it is intended to drill through the gas cap into the newly-discovered lime block.

Turner Valley has offered several such surprises in its long history. It has been said that the development of the Turner Valley field, which has extended over a period of 34 years, has been paced by the development of drilling equipment and drilling technology. Oil was first discovered in 1914, when a well drilled by Calgary Petroleum Products Company near a natural seepage of gas on the banks of the Sheep River yielded small quantities of high-grade oil at depths ranging from 1557 to 3960 feet. World War I may have retarded further development at that time.

Naphtha production, accompanied by a large volume of gas, was found in 1924 in Royalite 4, in which the Paleozoic Limestone was penetrated 290 feet to a total depth of 3740 feet. It yielded 600 barrels of naphtha and around 20 million cubic feet of gas per day.

Due in part to the limitations of cable tool methods then in use, intense activity was not commenced until late in 1928, when Okalta 1, drilled 1¼ miles south of Royalite 4, was brought in with an initial output of 500 barrels of naphtha per day.

Another major milestone in the progress of the field was passed in June, 1936, when Turner Valley Royalties 1 was brought in from total depth of 6828 feet, as the first large producer of high-gravity crude oil from the Paleozoic Limestone. With an initial yield of 850 barrels of oil and 2 million cubic feet of gas per day, it demonstrated the existence of a reservoir down the flank of the structure.

In recent years, heavy rotary rigs have been employed to the exclusion of old-time cable tool methods to drill wells which vary in depth from 6000 to 9600 feet. It is common practice to drill a nine-inch or 11-inch hole to about 700 feet, and then ream about 600 feet of this hole to 16¼ inches. Then 13⅜-inch casing is run to bottom of the enlarged hole and cemented with approximately 235 sacks. A nine-inch hole is cut to a depth about 20 feet below the top of the Madison Lime, of Paleozoic age, at which point seven-inch casing is set and cemented with about 600 sacks of common cement. Following this a 6⅛-inch hole is drilled through two porous zones to a point about ten feet below the top of a dark limestone or "black lime" marker, which is a normal section is encountered approximately 450 feet below the top of the limestone. Where water intrusion is a hazard, as in wells drilled far down on the west flank of the structure, the lower porous zone is not penetrated; and in some cases only part of the upper porous zone is cut. Only one porous zone occurs in the central part of the field.

Following completion, all wells are given one or more treatments of 15 percent commercial hydrochloric acid. The usual procedure is to give each porous zone a "wash" treatment.

After completion of all acid treatments, tests, etc., the well is produced through 2½ inch or three inch tubing. In some instances wells will not produce steadily without the aid of artificial lift, and steadier flow has been obtained by the aid of casing packers and bottom-hole chokes. Bottom hole chokes are also used to prevent freezing.

Po Valley Gas Vital to Italy's Fuel Economy

By GEORGE O. IVES
International Editor

Tabiano field in northern Italy, source of a small amount of crude oil production.

TRANSFER of the Arsa coal mines of the Trieste region from Italy to Yugoslavia under the terms of the Peace Treaty have increased the concern of the Italian economists as to sources of fuels. For some years prior to, and subsequent to World War II, considerable difficulty had been experienced in importing sufficient coal.

In the absence of substantial firm supplies of solid fuels, and inasmuch as no adequate sources of crude production have been discovered, Italy is turning to plans for fuller development and utilization of its natural gas deposits for industrial and domestic use. The activities of the Azienda Generale Italiana Petroli (AGIP) had been followed with interest during the years 1928 to 1940, and while success in finding oil has been negligible, some progress was made in outlining gas reserves. Since the end of the war accelerated activity in the Po Valley has built up producing potential and resulted in a network of gas transmission lines from fields to consuming centers.

Most of the Italian gas deposits now developed lie in the Po Valley of Northern Italy, being concentrated in the Lodi-Piacenza districts and in Roviga and Ferrara provinces, in addition to those existing along the Apennines Mountain chain from Piacenza to Forli, following what was known during the war as the Gothic Line. According to Italian geological sources, the probable gas areas cover 12 to 18 million acres, although the portion now under exploitation comprises less than ½ million acres, with most of that area not too intensively developed, and with a total yearly output of about 3½ billion cubic feet.

The greatest difficulty presently confronting operators in the development and exploitation of gas has been the problem of transportation to consuming centers. Although a network of gas lines has been devised to give the greatest practical distribution, most are in the prospective stage, and the five lines now actually operating carry gas to Florence, Milan, Bologna and Piacenza. None of the existing lines have capacity of more than 1½ to 2 million cubic feet a day, which is the approximate capacity of the line built in 1943 by Azienda Generale Italiana Petroli to help alleviate the fuel difficulties of the city of Milan during the war. The other lines connect Ca' Capello and Rovigo, Ca'Capello and Padua, Ferrara and Bologna, and Pietramala and Florence.

During 1948 the Italian government gave considerable attention to projects involving the construction of an extensive system of gas lines throughout the Po Valley, while the Ente Nazionale Metano is supervising the development of the natural gas resources. It has financed the Societa Metanodotti Padani of Padua to carry out construction of two additional major gas line systems.

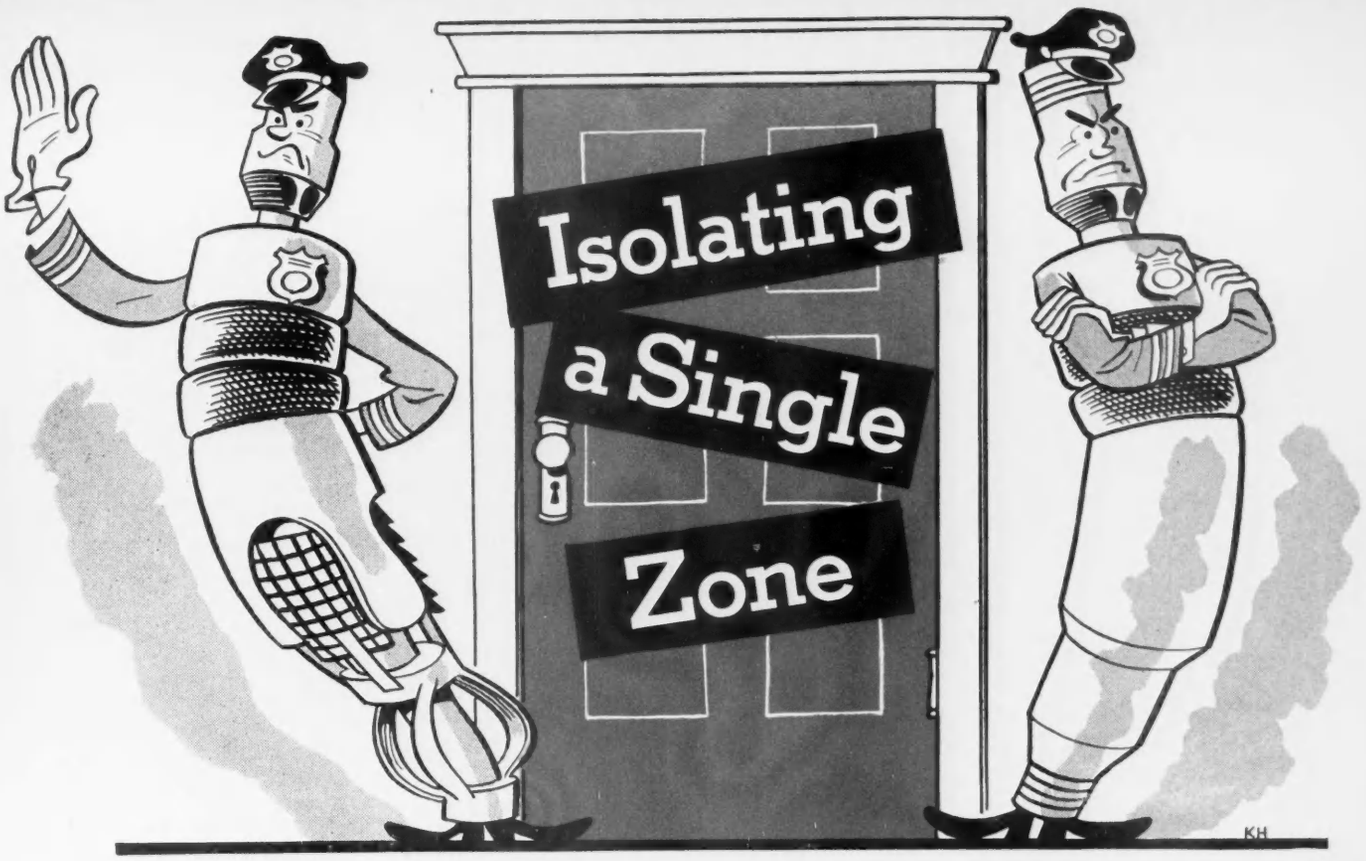
One is to connect Ferrara, Rovigo and Padua and establish a direct connection between Bologna and Padua with a ten-inch line. The other is to connect Contarina, Cavarzere, Padua and Venice.

At the same time the AGIP undertook construction of a gas line between Lodi and Milan with a daily capacity of 35 million cubic feet, and another from Lodi to Dalmine (Bergamo) which will have a capacity of 18 million cubic feet and which was scheduled to be operating by the end of 1948. This line was built to provide fuel for the Dalmine steel industry which has converted its coal-burning facilities to gas, and also to supply the Italcementi cement plant at Bergamo which has also converted to gas. AGTP is is also planning a gas line from Rovigo to Mantua and Milan to be completed within the next three years.

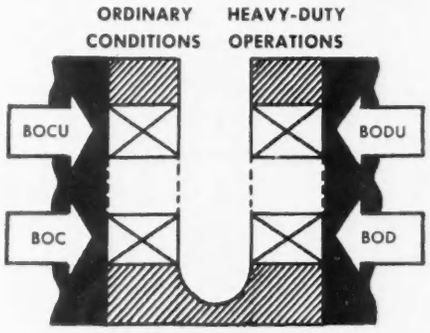
Of interest also is an announcement that a group of motor transportation firms headed by the Confederazione Generale del Traffico e dei Trasporti has approached the Ente Nazionale Metano with proposals to construct plants for compressing natural gas and distributing it in bottled form for motor transport use.

That gas supplies should be adequate if properly exploited seems likely from the reports submitted to the government.

GAS RESOURCES of the Po Valley take on greater economic importance with curtailment of sources of solid fuels and necessity of importing almost 100 percent of the liquid fuel. Current program includes development and transportation of gas throughout northern Italy. Planned refinery construction would make Italy one of the principal refining areas of the Mediterranean, with the Middle East as the major source of crude.

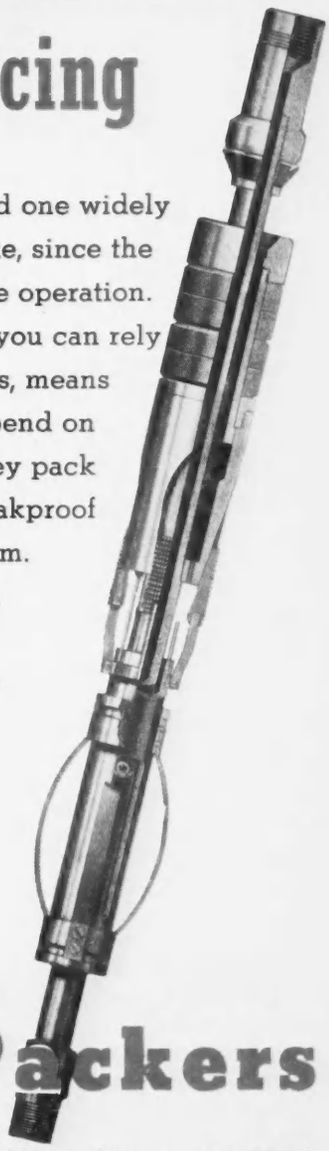


for Testing • Cementing • Producing



A very useful packer set-up, certainly, and one widely employed... but it's a tough set-up to make, since the failure of either packer will ruin the whole operation. To make it work, you must have packers you can rely on absolutely. And that, to many operators, means Lane-Wells Packers, because you *can* depend on them to do the job they were built for. They pack off, quickly, positively, when and where you set them; they maintain that leakproof seal as long as you want it; and they release easily when you pull them.

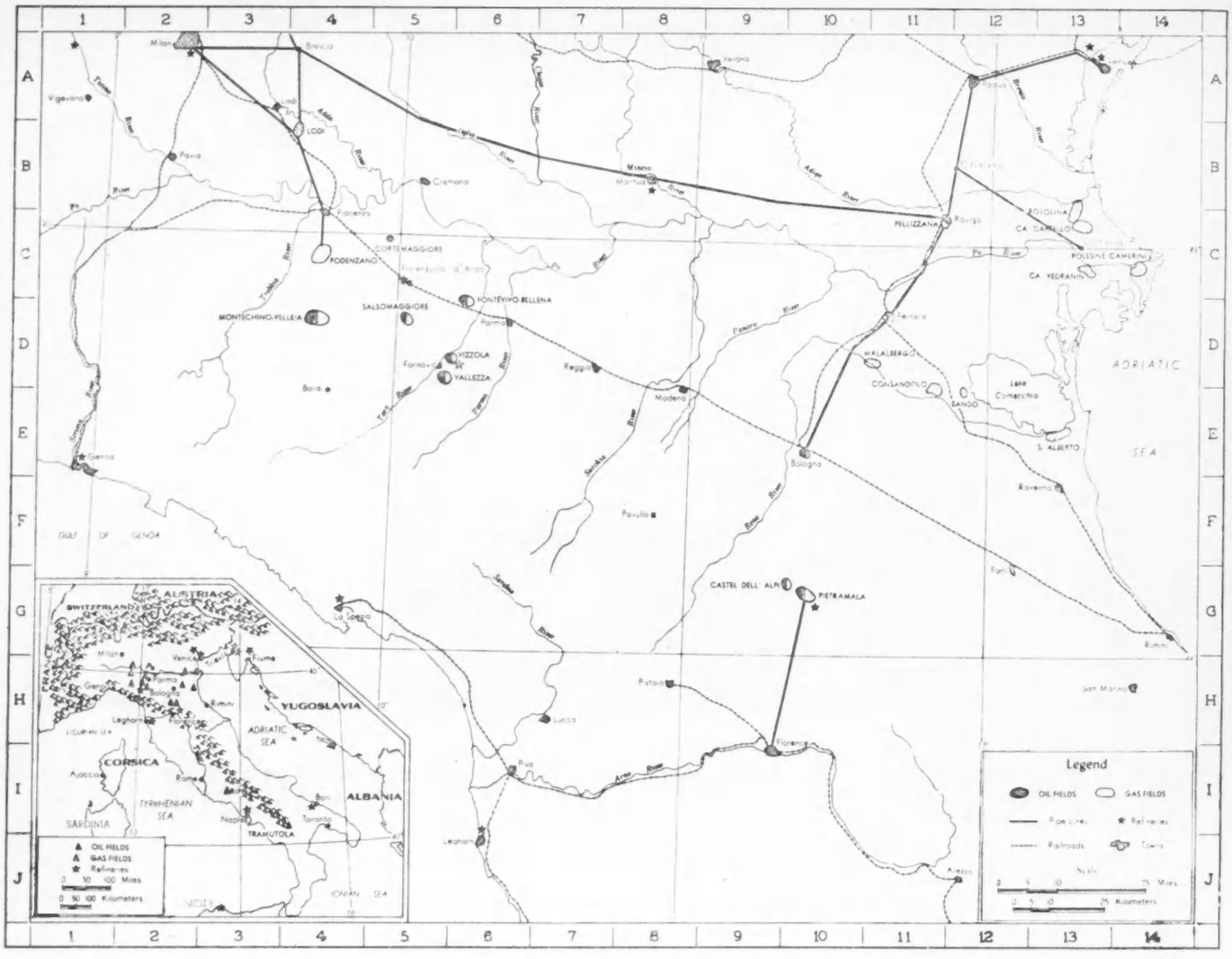
Their FLOSEAL Packing Assembly, which holds against differential pressures of 7,000 p.s.i. at temperatures to 300° F., springs back to practically normal when released and can be reset indefinitely, giving your Lane-Wells Packers long service life. And that is only *one* of many good reasons for using Lane-Wells Packers... You can get most types and sizes from stock in any one of more than forty-five Lane-Wells branches in the U. S. A. and in many foreign fields.



LANE WELLS for Packers

General Offices, Export Offices and Plant
5610 S. Soto St., Los Angeles 11, Calif.

24 HOUR SERVICE • 49 BRANCHES



System of gas pipe lines and refineries in Italy's Po Valley upon completion of present construction program.

The fields of Northern Italy as now exploited are situated in three general groupings: 1. The Ca'Capello (Rovigo) and Consandolo areas in the Po delta region where the gas area is estimated at roughly 6 million acres with production from as many as four and five horizons in Tertiary formations. The gas from this area contains 95 percent pure methane. Reserves are said to be in excess of 6 trillion cubic feet and it is thought that the present yearly output of 2 billion cubic feet could be more than doubled.

2. The Lodi area in the upper Po Valley, which includes such fields as Podenzano, Salsomaggiore, Rivanazzano, Crema and Lodi embraces an area of about 2½ million acres and contributes production of more than 1½ billion cubic feet a year from wells averaging no more than 1350 feet deep. Present output could be more than doubled without affecting estimated reserve of more than 10 trillion cubic feet.

3. The Pietramala group of fields lies north of Florence and includes Castell dell 'Alpi, Monte Busca, Porretta, Castagno, Viamaggio, etc. Current output is about 400 million cubic feet a year.

Other areas are in the southern part of the peninsula where gas has been found at Rivisondoli, Tramutola, Chianzano, Sant'Angelo, Casabona, San Nicola and Lesina Lake, but it is thought that development on an industrial scale will not begin there until some time in 1949 after funds have been made available through the ERP.

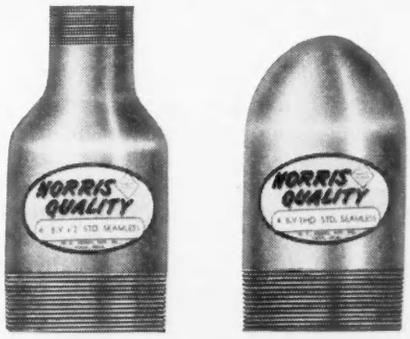
Although a number of the gas-producing structures also produce small amounts of oil, the total crude output is negligible when applied to the amounts required by Italian economy. Total oil production to date amounts to no more than 225 barrels a day, with nearly half of this coming from the fields near Parma which also account for substantial gas production. While emphasis is being placed at this time on the distribution and utilization of gas, plans are to continue the search for oil. This includes, in addition to work on the mainland, an exploration program on Sicily by MacMillan Petroleum Corporation. This American company has been engaged for the past two years in preliminary exploration work on a concession covering about 67,000 acres, and recently started drilling its first well, a wildcat in the province of Agrigento. Reports indicate that favorable areas have been outlined by geophysics and geology. An Italo-American company is being formed for operating in the area.

Societa Petrolifera Italiana, a subsidiary of the Standard Oil Company (N. J.) has continued its activity in the Po Valley, and a subsidiary of Anglo-Iranian Oil Company is carrying on intensive activity in the Abruzzi region around Pescara and Acquila, where indications of oil have been reported.

At the present time, however, the work of most of the operators is preliminary in nature, and the greater part of the actual drilling is being done by the AGIP. Thus far the agency has been handicapped by the shortage of adequate equipment for drilling to depths below 6500 feet, and only recently has the Italian government granted exchange credits for the purchase of heavy drilling machinery from the U. S. Italian geologists are of the opinion that any important oil resources of the presently developed gas regions will be in a depth

Supply Men know that . . .

Norris Fittings are *"ROLLING STOCK"*



The popularity of any product can best be learned from the men who sell it. Ask the supply men at your store about NORRIS Fittings.

Strength, perfect threading and NORRISIZING are the reasons why NORRIS Swaged Nipples and Bull Plugs are in use wherever oil is produced. These Threaded Fittings and NORRIS Welding Caps and Reducers are backed by our reputation for Quality Products. Made only from the finest seamless steel tubing, all NORRIS Fittings are precision built — field proven.

For additional information about NORRIS fittings write for Bulletin No. 31-A.

W.C. NORRIS, MANUFACTURER, INC.

TULSA, OKLAHOMA

BRANCHES:
HOUSTON, KILGORE, ODESSA, TEXAS; SALEM, ILLINOIS

EXPORT:
30 ROCKEFELLER PLAZA, NEW YORK CITY

Since QUALITY NORRIS PRODUCTS 1882

WEST COAST DISTRIBUTORS:
REPUBLIC SUPPLY COMPANY OF CALIFORNIA,
Los Angeles

range below 11,000 feet. The high cost of drilling in Italy would make any large-scale exploitation of such deposits a project requiring several years to develop to the point where it could be evaluated.

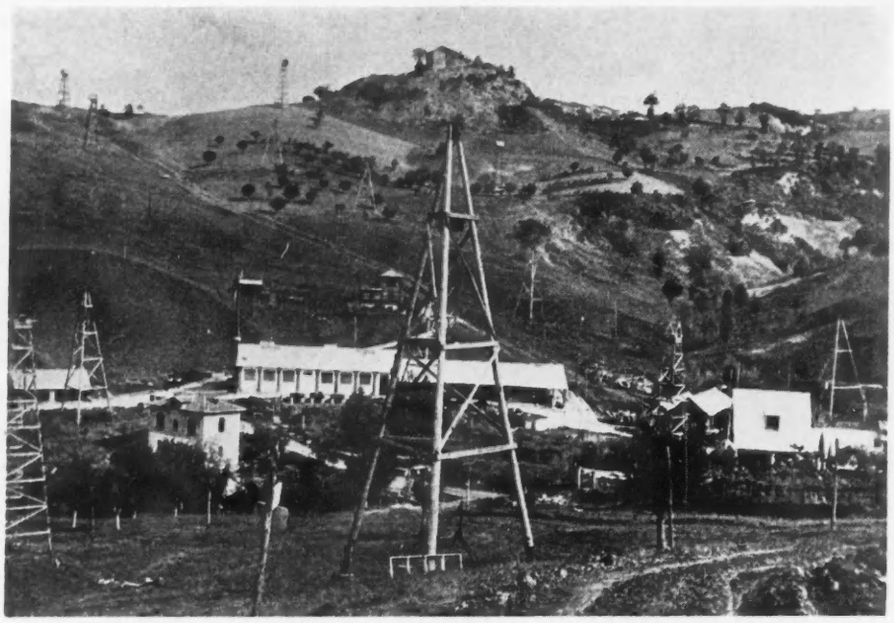
It has been reported that AGIP has made a discovery of oil in Northern Italy near the small town of Cortemagiore, south of the Po River, with oil found at 4700 feet. This propect is about ten miles east of the city of Piacenza, outside the areas previously proven for gas production. The search for oil is being carried farther south, with prospecting in the Pescara and Acquila areas of Abbruzzi, on the eastern side of the Peninsula, and AGIP has actually started drilling in the vicinity of Capo Santa Maria di Leuca on the extreme tip of the "heel" of the Italian Peninsula. A rig capable of drilling to 6500 feet is being used in this latter area.

Recently, in an effort to encourage foreign enterprise to aid in the search for indigenous oil resources, announcement was made by Ivan Matteo Lombardo, Minister of Industry and Commerce, that new and important legislation was being formulated. The new law will be designed to attract foreign capital and at the same time avoid danger of monopolies, either national or foreign.

Notwithstanding efforts to develop its own resources, the greater part of the nation's investment in its oil industry during the next few years will be in a complete rehabilitation and enlargement of its refining industry. Total investment for the next four years is expected to reach a total of $160 million, to be provided from Marshall Plan funds. Plans now under discussion provide for an increase in refining capacity from the present 50,000 barrels a day to approximately 200,000 barrels daily. Included in the program will be a greater decentralization of the refining industry and of storage facilities with provision made for locating more of the facilities in Northern Italy where lie the greater consuming areas.

Incident to refinery plans are proposals for pipe lines to handle crude from the Middle East or the Western Hemisphere.

Among projects for increased utilization of Middle East oil is the construction of a 93-mile eight-inch pipe line from the Gulf of Genoa to Trecate in the upper part of the Po Valley. This operation is being undertaken by Petrolea Company, controlled by the Fiat Company of Turin, in cooperation with Caltex interests. A refinery with capacity of 50,000 barrels throughput daily, the largest in Italy, is to be constructed on the Ticino River at Trecate, where it can serve most of upper Piedmont and Lombardy with products. The origin of the pipe line is to be at Vado Ligure, near Savona, and will be routed through Savona, Acqui, Alessandria and Mortara. Storage facilities will consist of about 500,000 barrels capacity at Vado Ligure and 1½ million barrels at the refinery site. In addition to serving the refinery, the pipe line is to be a link in the system to help supply continental Europe. The entire program will include the project of improvement of inland waterways so that the refinery and crude oil terminal on the Ticino River may be connected by water transportation to Switzerland, the entire Po Valley, and the Adriatic. It also is likely that the pipe line system may be extended to Turin, Genoa, Milan and points in Switzerland.



The Valleza field, found in 1907, still produces nearly half of Italy's oil output.

Refinery projects include doubling the capacity of Bari and Leghorn refineries, which are owned by the state and operated by the Aziendi Nazionale Idrogenerazione Combustibili, through an agreement whereby Standard Oil Company (N. J.) will furnish the funds and acquire an interest, in which case the state would release its ownership. Part of the plans for this project include a products pipe line from Leghorn to Eastern Italy and to Bologna.

Italian sources have speculated on the solution to the storage and dockage problem upon enlargement of the Bari refinery. Currently the refinery will have to make use of storage facilities at Taranto, and transport crude from that port to Bari, a distance of about 200 miles by water. It was suggested that storage facilities should be built at Bari, but in view of the fact that Taranto and Bari are only about 50 miles apart by land, it is likely that a pipe line would be built to connect the two and imported crude would still come in at Taranto. This is likely since fully laden vessels can dock at Taranto, while at Bari it is necessary to unload part of the oil into lighters before the tankers can tie up at the oil dock.

The government has also granted a concession for enlargement of the Industri Raffinazione Olii Minerali (Anglo Iranian-AGIP) refinery at Venice from about 10,000 barrels to 20,000 barrels daily. The Shell Group's refinery at La Spezia is to be enlarged to bring its capacity up to about 20,000 barrels a day, and Socony-Vacuum Oil Company's plant at Naples is to be boosted about 30 percent from its current capacity of 7800 barrels a day. The expansion in Shell's capacity is to be achieved through building a new plant at Massa Carrara. Other plans include construction of refineries at Vercelli, and at Mantova, both by local industrial concerns.

Coincident with the expansion in the refining industry, will be the construction of storage facilities at refineries and at accessible points on the coastline. Heretofore refiners in the northern area had to depend largely on the storage facilities in Southern Italy. Currently more than two-thirds of the storage capacity in the country is located in the southern part, while about three-fourths of the product consumption is in Northern Italy.

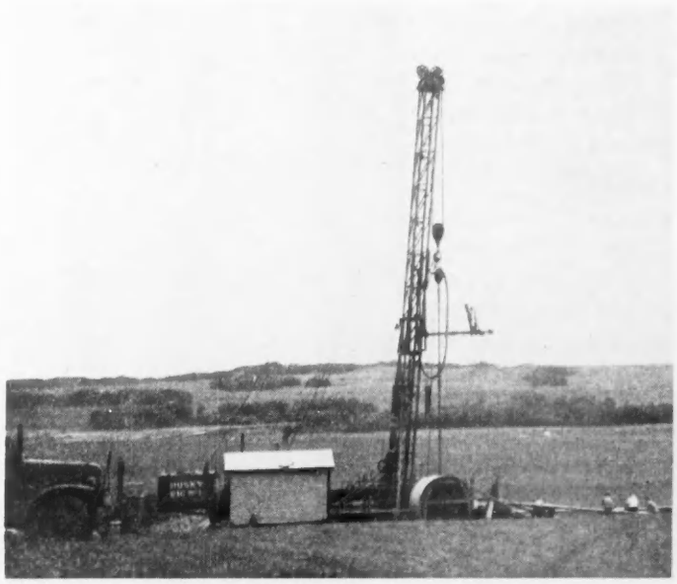
On Sicily, the Italian Ministry of Industry and Commerce has authorized AGIP to build a refinery at Punta Cugno near Augusta with a crude-charging capacity of 7500 barrels a day. The plant would be built with U. S. material purchased with ERP funds, and may be completed late in 1949. In its authorization, the ministry indicated it would place at the disposal of the plant the naval oil storage existing at Punta Cugno.

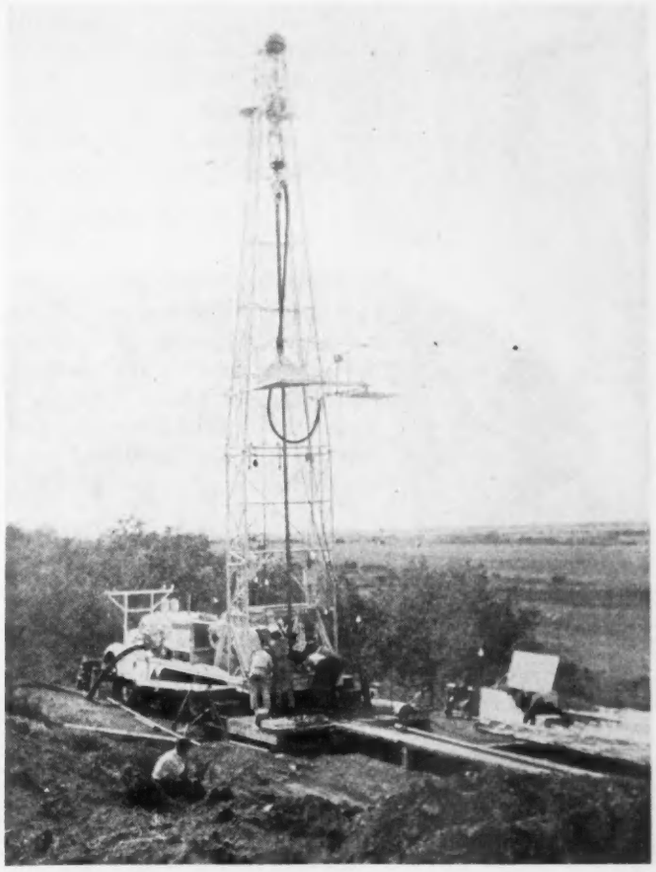
Saskatchewan Prepares For Oil Search

THE SUCCESS of exploratory operations in the Canadian province of Alberta, and the magnitude of discoveries during the past two years has made inevitable the eventual movement eastward into Western Saskatchewan.

In anticipation of this movement the authorities concerned with natural resources have instituted a program of preparation which includes preliminary basic geological work and prepartion of maps. At the same time it is formulating a policy to encourage wildcat ventures, liberalizing the terms under which equipment may be brought in.

By ROY E. LEIGH





Drilling operations in western Saskatchewan Province.

RECOGNIZING that the production of oil in substantial commercial quantities from the Devonian lime in the Leduc and Redwater fields of the Province of Alberta may give special impetus to the employment of geophysical methods for prospecting in neighboring Saskatchewan, the Geological survey of the latter province has assigned a crew of six men to the task of preparing surface structure maps to be used as a basis for geophysical prospecting and further geological reconnaissance.

This crew has been at work all summer in the Cypress Hills district of southwestern Saskatchewan; and similar preliminary geological work is intended to be enlarged and extended in coming years to include other methods and other areas. For example, core drilling will be employed in a preliminary geological survey to cover vast areas of glacial drift, ranging up to 500 feet in thickness, where ordinary methods are fruitless.

A preliminary report and map, covering the findings of this party, will be published by the survey before the end of this year, to be followed by a final report before next March 31. These reports will be made available to all.

Special interest was directed to the Cypress Hills district, where surface indications give evidence of a regional geological complexity which might prove favorable to the accumulation of oil and gas. In this locality, the Lundy interests of Vancouver are preparing to make a production test in their Interprovincial 1, near the Alberta-Saskatchewan border and about 25 miles southwest of Maple Creek, where good poro-

For Hole Enlargement...

The "Bull Nose" Type Scraper — Product No. 500-D — with its longer round-end nose is used for scraping in directional or "off-vertical" holes.

...no other tool is equal to the BAKER ROTARY WALL SCRAPER

When it is desirable to enlarge the diameter of an open hole to an extent considerably greater than the diameter of the casing, you can depend upon this strong, safe Wall Scraper with blades which open positively when pump pressure is applied. The uncased hole can be *enlarged at any point,* and by changing to progressively larger sizes of blades, an amazingly increased diameter can be secured. For example, the No. 6 Scraper can be run safely through 9⅝" A.P.I. casing, and then will ream from a minimum of 9¼ inches to a maximum of 19 inches by changing to increasingly larger sized blades.

RUGGED BLADES CLOSE SAFELY

Baker Wall Scraper blades have extra-long vertical cutting edges which prevent any tendency to "corkscrew" and insure scraping the maximum footage of full-gauge hole. And, when the Scraper is to be removed from the hole, the pumps are shut down and a strong spring aids in closing the blades into the body. These blades are made from special alloy steel forgings, and their cutting surfaces are hardfaced and set with Tungsten Carbide inserts to insure long cutting life.

MANY IMPORTANT USES

THE BAKER ROTARY WALL SCRAPER is extremely versatile, and is successfully and economically used for . . . Removing the mud sheath from the face of the producing formation prior to bringing-in the well — Gravel Packing — Bottlenecking — Enlarging at C.P. before running a combination string of casing — Removing sections of drillable pipe — Scraping a short distance below the shoe to expose fresh formation and test the water shut-off, as well as for many other applications in modern drilling.

A few of the worthwhile applications of the Baker Rotary Wall Scraper are shown on the opposite page and merit your careful study. Look also in your BAKER (or Composite) CATALOG for complete descriptions, illustrations and specifications.

Product No. 500-D

BAKER ROTARY HYDRAULIC EXPANSION WALL SCRAPER

Fig. 1

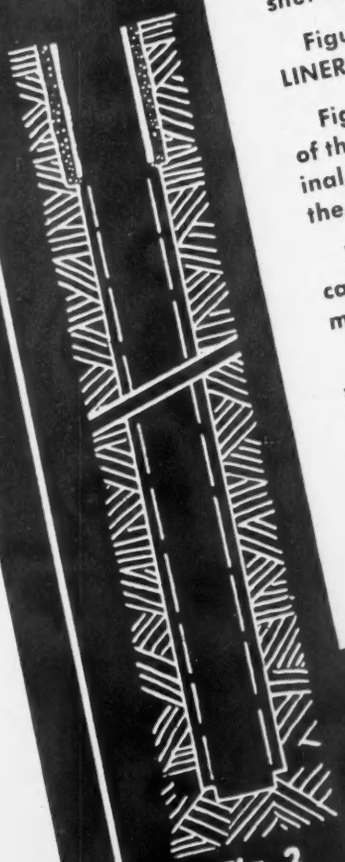


Fig. 2

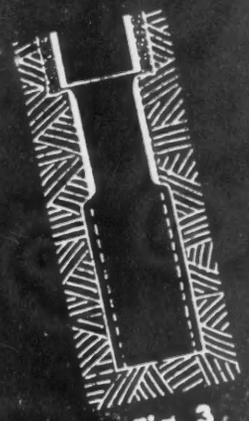


Fig. 3

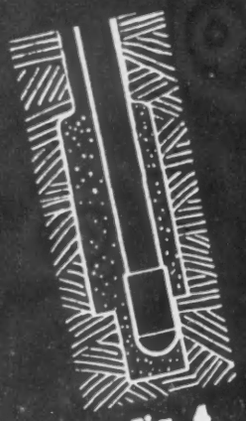


Fig. 4

Fig. 5

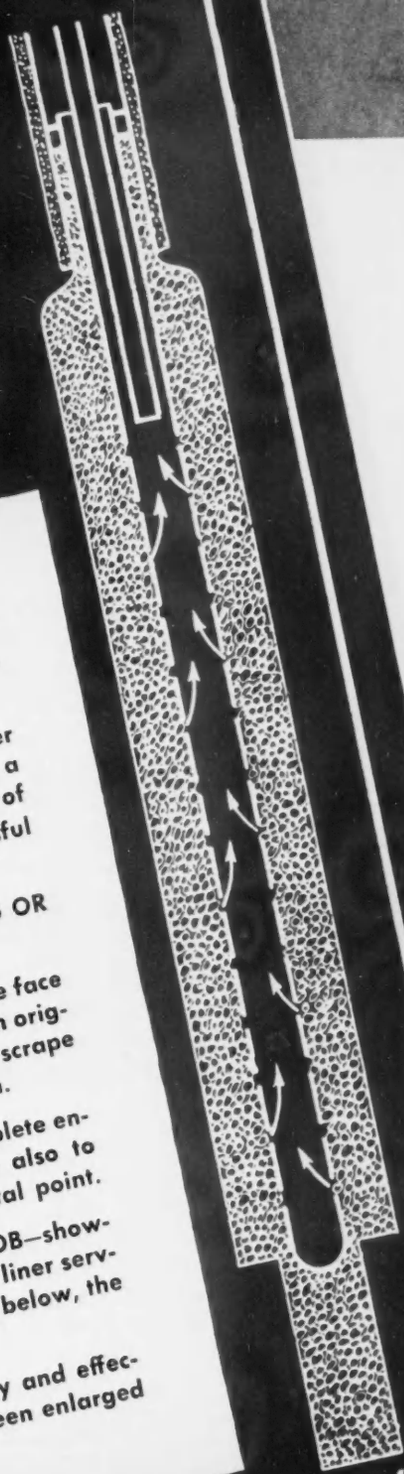


Fig. 6

These typical uses illustrate a few of the many worthwhile applications of the Baker Rotary Wall Scraper. Thousands of runs at varying depths, "wall scraping" different formations, in wells in every oil producing country, assure success in your well.

Figure 1—WATER SHUT-OFF TESTS are made after rat-holing below the shoe, "wall scraping" for a vertical distance of 5 feet or more to the gauge of the original hole (or slightly beyond). A successful shut-off test usually is secured.

Figure 2—ENLARGING HOLE TO SET CASING OR LINER with maximum ease and safety.

Figure 3—REMOVING MUD SHEATH from the face of the formation to permit cement to bond with original formation. This same procedure is used to scrape the face of the oil sand to increase production.

Figure 4—BOTTLENECKING to insure complete encasement of the shoe joint with cement; also to minimize hazard of channeling at this vital point.

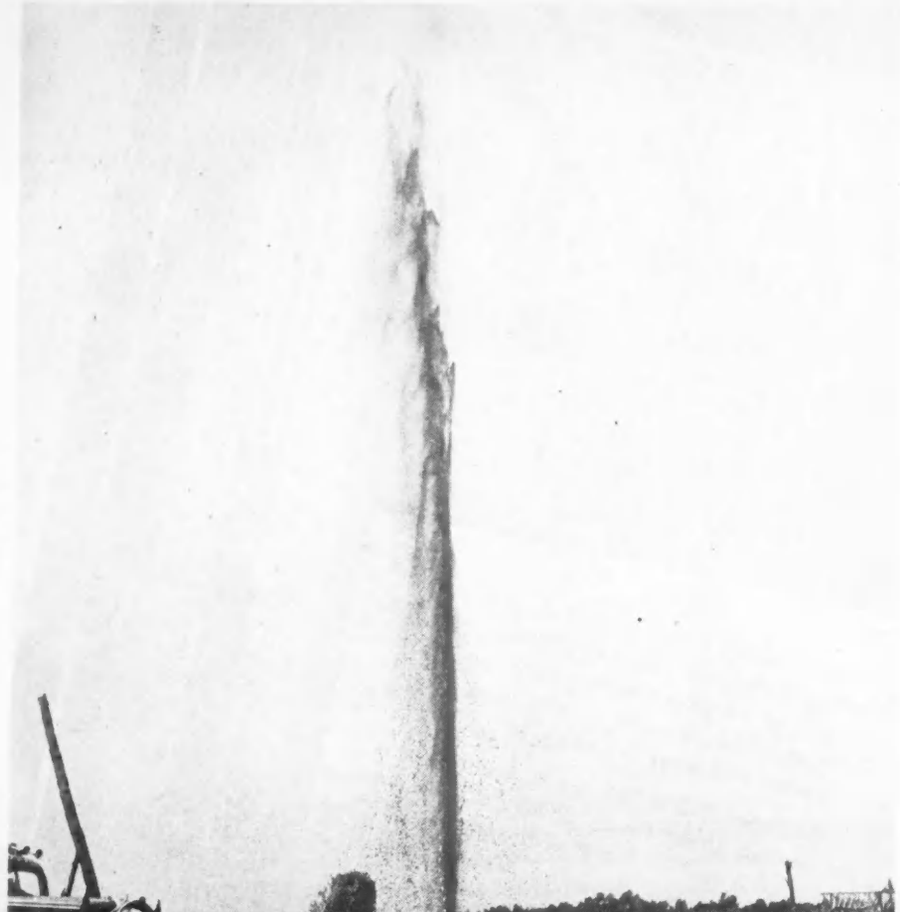
Figure 5—ENLARGING HOLE FOR C.P. JOB—showing "bottlenecked" section with casing or liner serving as water string above, and oil string below, the cementing point.

Figure 6—GRAVEL PACKING is easily and effectively performed when the hole has been enlarged with a Baker Rotary Wall Scraper.

BAKER

OIL TOOLS, INC.

Houston · Los Angeles · New York



Seismic crew touches off shot in Canadian prairie exploration.

sity was found in lime formation at approximately 4000 feet.

Geophysical methods do not lend themselves to prospecting for the shoestring sands of Lower Cretaceous age productive at Lloydminster, a two-year old shallow field which straddles the interprovincial boundary; but more recent developments at Leduc and Redwater, in lime and dolomitic formations of Devonian age, indicate that such methods may prove useful in prospecting the huge untested areas of Saskatchewan.

These rocks occur about 1500 feet below the surface in the northwest corner of the province and at about 4000 feet in the southwest corner, thus indicating that the potentially productive horizons may be found at relatively shallow depths. Dr. F. H. Edmunds, consulting geologist, formerly of the Dominion Geological Survey, and of the faculty of the University of Saskatchewan, has stated that[3] "There is no break in the geological conditions that control the accumulation of oil from one province to the other," referring to Alberta and Saskatchewan. In the entire province, less than a score of wells have been carried to depths below 2500 feet, but such drilling as has been done indicates that the same horizons which are productive in Alberta, to the west, are present at depths within easy reach of the drill in Saskatchewan.

Four Crews Working

Four geophysical crews are at work in various parts of the province at the present time, principally along the western boundary, adjoining the oil-producing province of Alberta. These include two parties put into the field by Radar Exploration Company of Toronto, on behalf of Bryan Newkirk of that city; a crew employed by Northwest Seismic Surveys of Calgary, working on behalf of Federated Co-operatives, a co-operative marketing enterprise of the prairie provinces, whose activities are being expanded into the refining and producing fields; and a fourth by Intermountain Exploration & Engineering Company, Ltd., of Calgary, who are reporting to Husky Refining Company, of Lloydminster, Canada, and Cody, Wyo.

At least one of these, Northwest Seismic Surveys, which began work about September 1, is expected to continue right through the winter, as it has been found that surveying in the muskeg area can be done more effectively in winter than in summer, when the surface is too boggy.[2]

W. James Bichan, director of the Mineral Resources Branch of the Department of Natural Resources and Industrial Development, at Regina, Saskatchewan, points out that normal drilling operations can be carried out during seven months of the year, from the first of May to the first of December, without expenditures for "winterizing"; and that, at an additional cost of about 30 percent, drilling operations may be continued during the cold, dry winter months of December, January, and February. Transport operations would be difficult during March and April, when the frost is coming out of the ground.

Wildcatters Welcomed

The Department of Natural Resources and Industrial Development has embarked upon a settled policy designed to foster and encourage the early development of the petroleum resources of Saskatchewan, even to the extent of offering permits and leases freely to foreigners, regardless of citizenship. To this end, regulations governing the acquisition of lands for purposes of exploration have been simplified to the extent that the assembly of test blocks would seem in many cases to be easier and, perhaps, cheaper than in the U. S. This derives in large measure from the fact that since the turn of the century all sub-surface rights have been reserved by the Crown. Prior to that time, patents granted to surface owners included oil and mineral rights. Thus, the mineral rights have been alienated under about 10 percent of the lands of the province; and approximately 90 percent are still held by the Crown, meaning, to all intents and purposes, the Province of Saskatchewan.

For a fee of $250 an approved applicant may secure a permit to do geological or geophysical work throughout an area totaling 250,000 acres of Crown mineral lands, which may be interspersed with freehold lands, Crown reserve lands, and lands already leased by other operators. Such permits are good for a term of one year, but are renewable upon showing of good faith for three additional quarterly periods,

not to exceed a total term of 21 months.

Within that period, the permittee may select one or more drilling blocks of 35,000 acres each, which will be assigned to him under firm lease contracts calling for the commencement of operations for drilling within 60 days. However, about 25 percent of the lands interspersed, or checkerboarded, among such drilling blocks, will be reserved by the Crown.

Rentals for the first year of a lease contract are computed at the rate of 50 percent per acre, and are payable in cash. Rents for the second and subsequent years accrue at the rate of $1 per acre per year; but such subsequent rental obligations may be discharged in whole or in part by a system of credits based on monies expended in drilling operations. Thus, 50 percent of all drilling costs may be applied as a credit against rentals. Under this plan, all rental obligations may be covered by credits derived from drilling operations, if enough of such work is done. For example, $70,000 worth of drilling would serve to liquidate all rental obligations under a lease contract covering a test block of 35,000 acres.

Compensation for damages suffered by owners of surface rights, who have no royalty rights and no interest in the sub-soil, is determined under a formula established by an Order in Council, or government decree, which is considered to be fair to both parties. Such payments usually range from $200 to $300 per well site, including easements for roadways, etc.

Drilling rigs and similar equipment may be brought in free of duty under temporary permits of six months duration, which permits are renewable for additional periods of time.

In the Cypress Hills district, prospecting permits have been issued to Federated Co-operatives to the extent of 500,000 acres; to the Lundy interests, of Vancouver and Calgary, covering 250,000 acres; to Husky Refining Company, 500,000 acres; and to Bryan Newkirk of Toronto, 250,000 acres. The Newkirk group also holds an additional ¼ million acres under permit in other areas along the interprovincial boundary. Husky Refining has recently converted certain of its preliminary prospecting permits into six drilling licenses, or firm lease contracts, of 35,000 acres each. These are northeast of the Lloydminster Field.

Other permittees who have been authorized to do reconnaissance work in Saskatchewan includes the following, with acreage:

Husky Refining Company, 214,038; C. R. Bronson, 118,240; H. Oakley, 34,560; C. H. Withers, 34,560; Canadian Petroleums, Ltd., 34,400; J. D. Hunter, 34,560; A. H. Brown, 34,370; R. A. Robertson, 34,560; J. L. Graham, 249,760; R. A. Culver, 34,120; A. O. Store, 34,468; N. D. Raymond, 88,160; A. Federspiel, 34,560; Northern Gas Distributors, 28,000; T. E. Keyes, 250,000; Saskatchewan Federated Co-operatives, 207,040; Consumers Co-operative, 251,040; J. L. Graham, 250,080; B. F. Lundy, 34,560; Aubelle Mines, 250,000; Astro Mining, Ltd., 250,000.

REFERENCES

[1] From Alberta Minerals Number of *Western Miner*, of Vancouver, B. C., August, 1948.
[2] Handley, E. J., WORLD OIL, June, 1948, P. 213.

Underwater Drilling Program Begun off Coast of Borneo

British Malayan Petroleum Company, an operating member of the Shell Group, is starting work on an extensive program of coastal underwater drilling off northern Brunei, British Borneo. The campaign will determine the possibilities of production under the waters of the China Sea.

Since it is a jungle area, much headquarters construction will be necessary. The actual drilling is to be done from jetties rather than from separate structures such as are used in the Gulf of Mexico, and a complete town is to be built to accommodate employes. The camp will also include the usual collection of shops, clubs and other recreational facilities in addition to the actual necessities of living. It will be large enough to take care of 1400 people.

The Seria field, near the coastline, is one of the most important producing areas in the region, producing from Tertiary sands at depths ranging upward from 6400 feet. Since the close of the war the field has upped its prewar production nearly four-fold and keeps from three to five rigs running. Latest production figures showed the field producing 53,000 barrels a day, most of which is from the 35 producing wells drilled since the beginning of 1947.

Deep Wildcat Program In Southern Trinidad

Trinidad Petroleum Development Company has announced that it will start soon on exploratory operations in the Moruga area of Trinidad which will involve drilling of wells to depths hitherto unattained in Trinidad. The company has already started the preliminary work which includes building roads, clearing jungle and construction of necessary facilities in conjunction with a large-scale wildcat venture in that particular type of country. On the strength of reconnaissance work it is thought that at least six exploratory wells will be drilled during the campaign.

Work to date has consisted of geological and gravimetric work in an area containing more than 10,000 acres and this original survey has led to the belief that a major exploratory program would be justified.

The company is negotiating for heavier drilling equipment than it has had to employ in its other Trinidad operations, with a view toward deeper drilling not only in this present wildcat project, but elsewhere on the Island. It holds a considerable amount of acreage in the form of Crown Lands and private lands and is operating producing properties at Coora, Los Bajos, Quarry and Point Fortin (South), from which it is currently producing crude oil amounting to about 7200 barrels daily. It is not operating refinery equipment in Trinidad, all of its production being sold to United British Oilfieds of Trinidad, a Shell Group company.

In making the decision to invest additional capital in heavy equipment, officials of the firm are recognizing the fact that the long term future of the oil industry in Trinidad depends not only on finding new producing areas, but in drilling to successively greater depths in the proven fields.

Soviets to Reopen Shale Works in Estonia

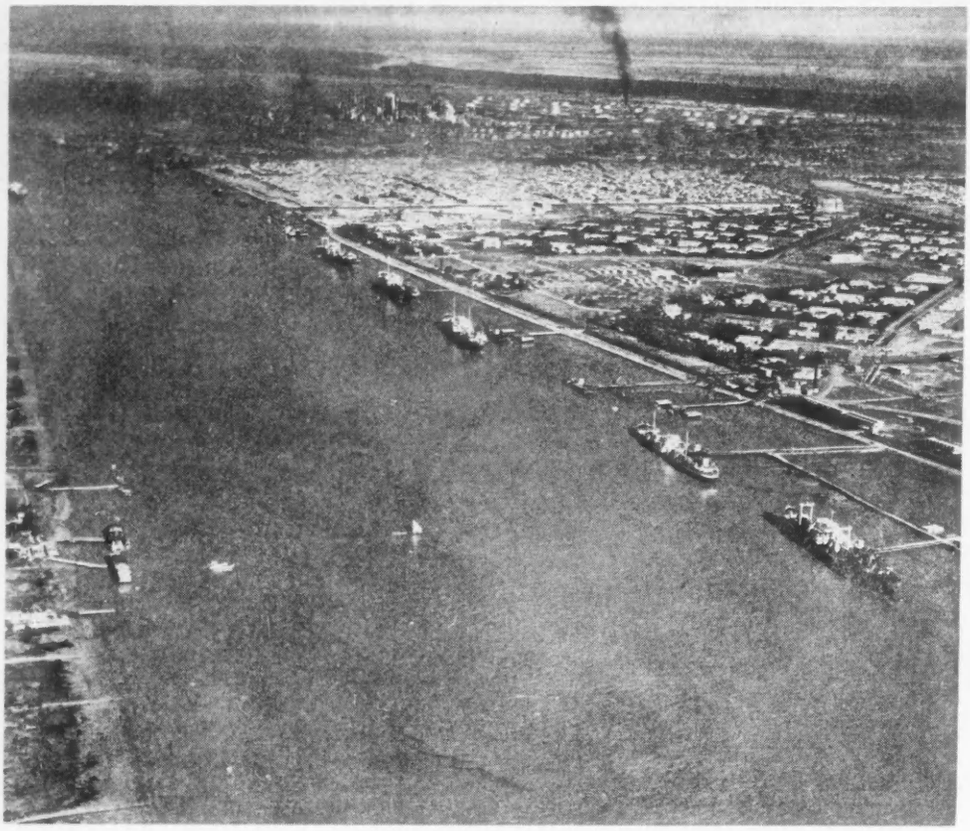
The Soviet authorities in the former republic of Estonia are said to be paying a great deal of attention to the exploitation of the Sillamae oil shale deposits. These important resources yield a pure fuel of special value for the propulsion of submarines and other vessels, according to reports. It is also reported that the shales contain a relatively concentrated amount of uranium, running as much as 200 grams per ton.

The deposits originally belonged to a Swedish group and were later occupied by the Germans who destroyed the surface installations and part of the mines in the course of their retreat. They are being restored by the Russians, but there now appears to be a shortage of technologists, and reports reaching here say the Soviets have made appeal to those specialists who fled to Sweden or Germany to return to Estonia and help with the exploitation of the shale. The same reports indicate the project is being administered directly from Moscow on account of their economic and strategic importance.

Austrian Find Reported

Austrian government officials announced that the Soviet administration in Austria has found oil beneath a suburb of Vienna at a depth of 1150 feet. The new area may be part of an oil trend extending east as far as the point where the Austrian, Czechoslovakian and Hungarian frontiers meet, 37 miles from Vienna.

Huge Built



British tankers in the Shatt-al-Arab River at Abadan, oil outlet terminal for Iranian oil and petroleum products.

ANGLO-IRANIAN Oil Company's subsidiary, British Tanker Company, will acquire 53 new tankers for its fleet by 1951. The new vessels will aggregate 742,950 deadweight tons and will raise the company's fleet from the present total of 109 ships of 1,270,275 deadweight tons to a total of 162 vessels of 2,013,225 tons.

In 1939, at the outbreak of World War II, British Tanker Company owned 93 tankers of nearly a million deadweight tons. However, during the war losses were high; 44 ships or about a third of the original fleet were destroyed by enemy action. By October, 1946, tonnage had reached the pre-war level when Mrs. Winston Churchill christened the 12,412-ton M. V. "British Baron."

At the present time Anglo-Iranian's tanker company has 46 tankers added to its fleet since the end of the war, including 10 T-2 type ships bought from the United States. Ships purchased in this country were the "Beecher Island," "Cottonwood Creek," "El Morro," "Fort Stevens," "Mesa Verde," "Red Bank," "Rogue River," "Smoky Hill" (all built in 1944), and "Chisholm Trail" and "Fort Frederica" (built in 1945).

British Tanker Company has received delivery of 12 new tankers during 1948, and the current building program calls for delivery of 15 more, aggregating 191,150 tons, in 1949, and 22 tankers totaling 253,900 tons in 1950.

Building progress to date shows that ten new tankers have been launched and fitted out. These are shown in Table 1. Eleven other tankers (Table 2) have been laid down but not yet launched. Orders for the remaining 32 have been placed (see Table 3).

With the exception of the 28,000-tonners, all these new vessels are diesel-driven. The British Tanker fleet consists predominantly of ships of 12,000-

TABLE 1

Builders and Location	D. W. Tonnage	Machinery
Blythswood Shipbuilding Co., Ltd., Glasgow	1 x 16,000	Baclay Curle—Doxford.
	1 x 12,250	Kincaid Burmeister and Wain.
William Doxford and Sons, Ltd., Sunderland	1 x 8,400	Doxford.
	1 x 12,250	Doxford.
Harland and Wolff, Ltd., Belfast	1 x 12,250	Harland and Wolff—Burmeister and Wain.
Harland and Wolff, Ltd., Govan	1 x 12,250	Harland and Wolff—Burmeister and Wain.
R. and W. Hawthorn Leslie and Co., Ltd., Hebburn-on-Tyne	1 x 12,250	Hawthorn-Doxford.
Lithgows, Ltd., Port Glasgow	1 x 12,250	Kincaid-Burmeister and Wain.
Swan Hunter and Wigham Richardson, Ltd., Wallsend-on-Tyne	1 x 16,000	Swan Hunter—Doxford.
Joseph L. Thompson and Sons, Ltd., Sunderland	1 x 8,400	Richardson Westgarth—Doxford.

TABLE 2

A further eleven tankers have been laid down but not yet launched.

Builders and Location	D. W. Tonnage	Machinery
Blythswood Shipbuilding Co., Ltd., Glasgow	1 x 12,250	Kincaid—Burmeister and Wain.
Cammell Laird and Co., Ltd., Birkenhead	1 x 12,250	Harland and Wolff—Burmeister and Wain.
William Doxford and Sons, Ltd., Sunderland	1 x 12,250	Doxford.
Furness Shipbuilding Co., Ltd., Haverton Hill-on-Tees	1 x 12,250	North Eastern Marine—Burmeister and Wain.
Harland and Wolff, Ltd., Govan	3 x 12,250	Harland and Wolff—Burmeister and Wain
R. and W. Hawthorn Leslie and Co., Ltd., Hebburn-on-Tyne	1 x 16,000	Hawthorn—Doxford.
Sir James Laing and Sons, Ltd., Sunderland	1 x 16,000	Doxford.
Swan Hunter and Wigham Richardson, Ltd., Walker-on-Tyne	1 x 16,000	Wallsend Slipway—Doxford.
Swan Hunter and Wigham Richardson, Ltd., Walker-on-Tyne	1 x 12,250	Swan Hunter—Doxford.

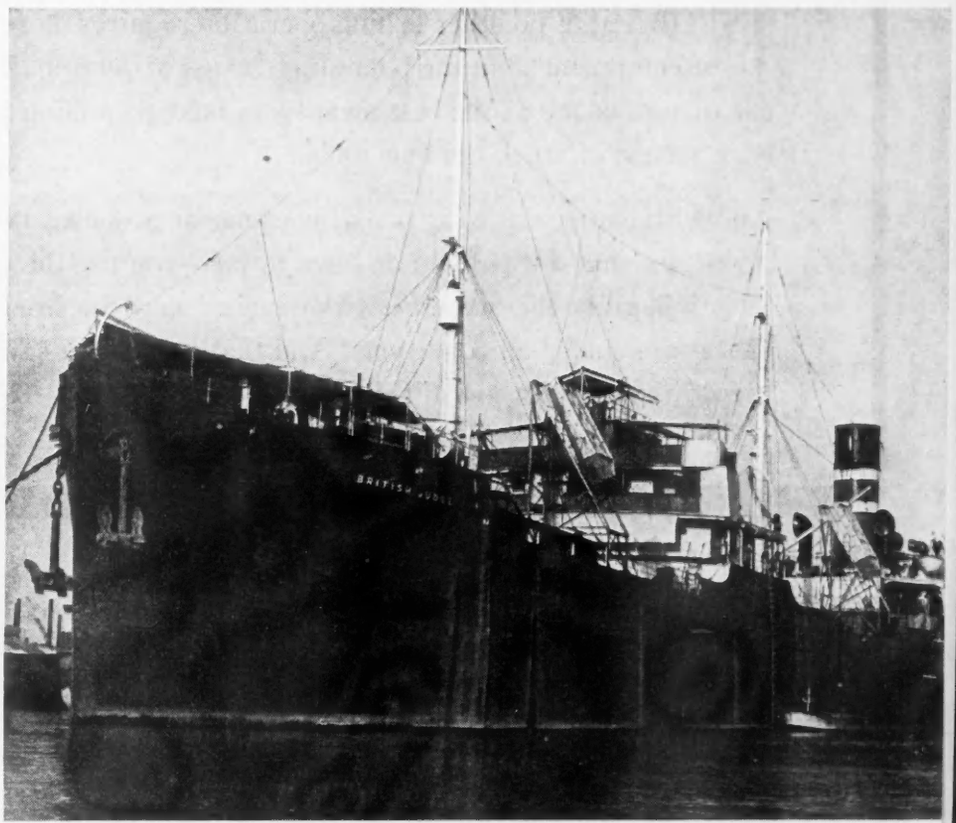
New Tanker Fleet Being By Anglo-Iranian

FORTY SIX TANKERS have been added to the company's fleet since the end of the war and an additional 53 to be acquired by 1951 will increase its fleet to 162 vessels.

deadweight tons, designed for suitability in trading to many parts of the world. A typical example is the 12,250-ton motor tanker "British Endeavour" recently launched at Hebburn-on-Tyne. She has a single screw Hawthorn-Doxford engine developing 3,100 brake horsepower on service at about 105 revolutions per minute, giving her a speed of 12 knots. Her overall length is 490 feet and breadth 61 feet, 9 inches.

It appears certain that the present building program will be by no means the end of the expansion of the fleet, and notwithstanding the economy of tanker tonnage that will be effected by the Middle East Pipelines project (in which Anglo-Iranian is partnered by Standard Oil Company (N. J.) and Socony-Vacuum Oil Company for the construction of a pipe line from Abadan and Kuwait to the Levant coast), there will still be a need for new tanker tonnage.

At the launching of the "British Marquis" in 1946, Sir William Fraser, Chairman of Anglo-Iranian, said he visualized a fleet of 200 tankers. Taking 16 years as the average life of a ship, such a fleet when completed would entail a replacement program requiring the launching of a tanker a month.



Closeup of a postwar constructed tanker of the British Tanker Company

TABLE 3

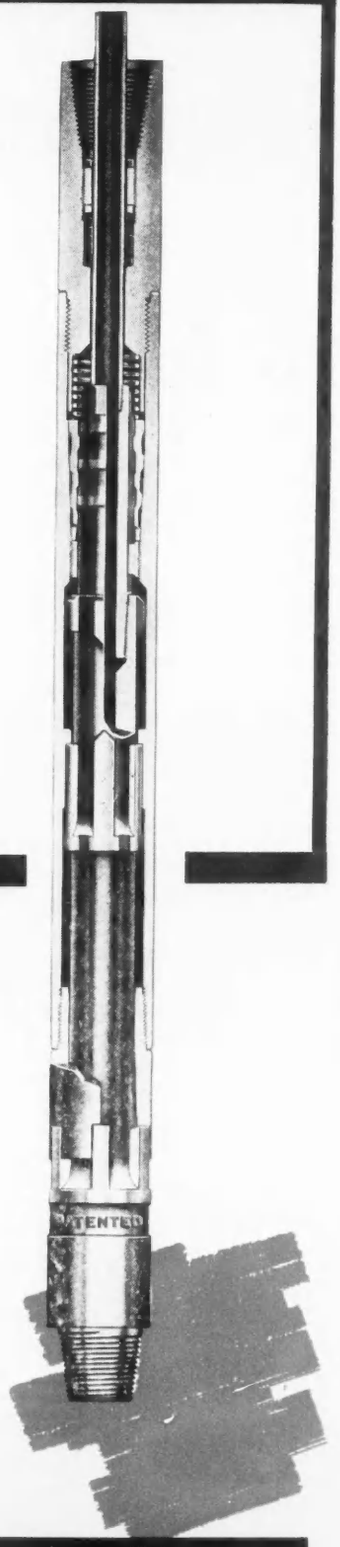
Builders and Location	D. W. Tonnage	Machinery
Blyswood Shipbuilding Co., Ltd., Glasgow	1 x 12,250	Kincaid—Burmeister and Wain.
Cammell Laird and Co., Ltd., Birkenhead	1 x 12,250	Kincaid—Burmeister and Wain.
Cammell Laird and Co., Ltd., Birkenhead	1 x 28,000	Geared Turbine.
William Doxford and Sons, Ltd., Sunderland	2 x 8,400	Doxford.
	2 x 12,250	Doxford.
Furness Shipbuilding Co., Ltd., Haverton Hill-on-Tees	1 x 12,250	Vikers—Doxford.
	1 x 12,250	Hawthorn—Doxford.
Harland and Wolff, Ltd., Pelfast	3 x 12,250	Harland and Wolff—Burmeister and Wain.
Harland and Wolff, Ltd., Pelfast	1 x 28,000	Geared Turbine.
Harland and Wolff, Ltd., Govan	1 x 12,250	Harland and Wolff—Burmeister and Wain.
R. and W. Hawthorn Leslie and Co., Ltd., Hebburn-on-Tyne.	1 x 16,000	Hawthorn—Doxford.
R. and W. Hawthorn Leslie and Co., Ltd., Hebburn-on-Tyne.	1 x 28,000	Geared Turbine.
Sir James Laing and Sons, Ltd., Sunderland	2 x 12,250	North Eastern Marine—Doxford.
Lithgows, Ltd., Port Glasgow	3 x 12,250	Kincaid—Burmeister and Wain.
Smith's Dock Co., Ltd., Middlesborough	1 x 8,400	Hawthorn—Doxford.
Swan Hunter and Wigham Richardson, Ltd., Wallsend-on-Tyne	2 x 16,000	Wallsend—Doxford.
Swan Hunter and Wigham Richardson, Ltd., Wallsend-on-Tyne	1 x 28,000	Geared Turbine.
Swan Hunter and Wigham Richardson, Ltd., Walker-on-Tyne	2 x 12,250	Swan Hunter—Doxford.
Joseph L. Thompson and Sons, Ltd., Sunderland	3 x 8,400	Doxford.
Fairfield Shipbuilding Co., Ltd. Glasgow	1 x 28,000	Geared Turbine.
Vickers Armstrong, Ltd., Barrow in Furness	1 x 28,000	Geared Turbine.

NUMBER 1 OF A SERIES

Straight Pull Jar Reduces Risk of Twisting Off in the Hole

PROBABLY no other fishing operation requires more abuse of equipment than the pounding strains of *jarring*. Yet the use of jars is one of the best means you have of pulling a stubborn string of stuck drilling tools.

And with equipment wear one of your major problems now, it's important that—when you *do* have to jar—you use the type of tool that gives the smoothest, the easiest and the least risky operations under all conditions. And that's why you can't beat the Bowen *straight-pull* Fishing Jar!



This Jar is a rugged, tough customer for any fish—but it requires only *straight pull* for delivering a solid blow. And because it is so easily operated without risky torque loadings, it's FAST—an average of 10 hard blows per minute can be struck by simply raising and lowering the fishing string!

FULLY ADJUSTABLE FOR INTENSITY OF BLOW

Because the Bowen Jar requires only *upward pull* for delivering the blow, the tool is indispensable, for use with many types of fishing tools which set and release on rotation of the string. *Moreover, the blow is fully adjustable for intensity without even coming out of the hole.* If heavier blows are required, for example, a *sixth* of a turn to the right does the trick, increasing pull required to trip the jar by one or two points. No torque stays in the string, and you just reverse the procedure to decrease pull!

So, next time, order the Bowen *straight-pull* Jar for maximum protection of your equipment . . . for easier, safer operation. Five strategically located Bowen Service Stores in California and one in Casper, Wyoming, are open 24 hours a day for your convenience!

Write today for your copy of the Bowen Catalog!

SR BOWEN CO

MAIN OFFICE AND PLANT:
11008 SOUTH NORWALK BOULEVARD
SANTA FE SPRINGS, CALIFORNIA
EXPORT OFFICE:
30 ROCKEFELLER PLAZA
NEW YORK CITY, NEW YORK
EXPORT REPRESENTATIVE: VAL. R. WITTICH, JR.

Oil Leasing Procedure In Alberta

By ROY E. LEIGH

THE future status of the oil industry of Alberta, Western Canada, apparently was settled in the last general election, wherein members of the Social Credit Party, campaigning as proponents of private enterprise, gained an overwhelming majority in the Provincial Parliament. The matter of socialization of industry in general, and of the oil industry in particular, was a major issue in the last political campaign; and the present government of Alberta, as victor in that election, is determined that its vast oil reserves, now very promising on the showings of two new oil fields of the first magnitude, shall be developed by free enterprise. Not only that, but a policy of open welcome to foreigners and foreign capital has been established. For example, a citizen of the U. S. st nds on equal footing with a Canadian subject insofar as laws, rules, and regulations pertaining to the leasing of Crown oil lands are concerned.

All sub-soil rights have been reserved unto the Crown in all lands granted to settlers since October 31, 1887, unless minerals were specifically mentioned and conveyed in patents issued. This means that the Province of Alberta, as successor to the federal or Dominion government insofar as such matters are concerned, is now the owner of all oils, gas, and other minerals which may underlie lands alienated since that date. However, land-owners called "freeholders" are left in possession of all mineral rights under lands granted before that date. The province embraces about 163 million acres, of which about 10 percent is freehold. At the present time, about 22½ million acres are held under "reservations" conveying the right of preliminary examination, as explained below; and about 2,750,000 acres are held under firm leases conveying the right to extract oil, gas, and other minerals.

Freehold rights, which remain valid and effective, occur generally in the older settled communities of this and other provinces; and, in such areas, prospective leasees of oil rights may deal directly with individual freeholders, as in the U. S. *The Canadian Pacific Railway and Hudsons Bay Oil & Gas Company, who early became interested in mining and minerals in Canada, are in a fortunate position as owners of freehold rights, including oil, gas, and other mineral rights, under vast areas of Canadian lands.

*In the Province of Alberta, alone, 9,807,174 acres were patented to the Canadian Pacific Railway Company, with other grantees as follows:

Calgary and Edmonton Railway Co.,	1,806,168 acres
Alberta Railway and Coal Co.,	1,096,217 acres
Manitoba Southwestern Railway Co.,	319,680 acres
Canadian Northern Railway Co.	859 acres
Great North West Central Rᵽ. Co	640 acres
Pipestone Extension, Souris Branch, Canadian Pacific Railway Co.	521 acres
Manitoba and Southeastern Railway Co.	312 acres
Souris Branch, Canadian Pacific Ry. Co.	160 acres
Total	13,031,731 acres

In connection with lands in areas settled since 1887, prospective leasees would deal with the government of Alberta through H. H. Somerville, Superintendent of Mining Lands, Administration Building, Edmonton, Alberta; or the Mining Recorder for the specific district. With reference to such lands, the right of ingress and egress for purposes of exploration, drilling, and production may be acquired by owners or lessees of minerals. This may be done by direct negotiation with the owners of surface rights; or, in event of failure of such negotiations, by appeal to the Right of Entry Arbitration Board. In other words, a lessee may not arbitrarily be denied access to leased lands.

Oil operations under such conditions occasionally lead to friction between owners of agricultural rights and holders of oil rights. Farmers not owning the oil and other minerals under their lands find, or sometimes may pretend to find, difficulty in understanding why other farmers, more fortunately situated as owners of freehold rights granted prior to the critical date, are entitled to share in oils produced from their lands. To overcome this difficulty, Imperial Oil Company Ltd., and others operating in the new fields of Alberta have from time to time purchased the surface owners' rights in certain proved areas. This may or may not mark the establishment of a new policy; but it is not absolutely necessary to make such outright purchases.

In that portion of the new Leduc field, near Edmonton, which is south of the North Saskatchewan River, about 50 percent of the lands are freehold, mineral rights under the remainder having been reserved unto the Crown. In the newly-proved Woodbend sector, in the same general area but north of the River, all mineral rights were retained by the Crown, meaning, for all practical purposes, that these rights are now vested in the Provincial government.

Land and leasing regulations of the provincial government are designed to discourage the speculator who might seek to hold undeveloped lands for enhancement in value in absence of actual work thereon; but are fairly liberal toward the bona fide operator, wildcatter, or even promoter, who is willing and able to come in with qualified personnel and suitable equipment to make an earnest effort to find and develop new oil deposits. Operators who can show good faith are given lands free of cash rent for one year.

For a fee of $250 and a deposit of $2500.00, an approved oil prospector may secure a reservation of all prospecting rights not to exceed 100,000 acres. (This deposit will be refunded upon termination or expiration of the "reservation," if all provisions of the oil and gas regulations have been complied with; and if the permittee has performed all of the duties assumed by him under the terms of his contract.) However, this cash fee is not the moving consideration in such a transaction, as the permittee is required to carry out substantial work in exploration. In this connection, within 90 days after the

granting of a reservation conveying the right of preliminary examination, the permittee is required to submit a satisfactory program of proposed exploration, which may include geological reconnaissance, geophysical exploration, coring, test drilling, etc. Any subsequent change in such program must be approved by the Department of Lands and Mines.

Such a "reservation" confers the exclusive right to go on the land for all such purposes during its term, for which the permittee is allowed a primary term of four months, which under circumstances indicating diligence on the part of the prospector may be extended for as much as two additional periods of four months each, totaling one year if the primary term is included. Further extensions, after one year, are contingent upon the continuation of work and upon the payment of fees of seven cents per acre during each of the first two quarterly extensions and eight cents per acre during each of the last two three-months periods. In addition, the regulations also provide for continuation or extension of the "reservation" for still further periods of three months each, provided drilling is being done. The first renewal under this subsection of the regulations is granted for a fee of 10 cents per acre, the second at 15 cents per acre, the third at 20 cents per acre, and the fourth at 25 cents per acre, totaling 70 cents per acre per year.

Upon completion of preliminary work, such as geological or geophysical examination, core drilling, test drilling, etc., the permittee must file with the Superintendent of Mining Lands named above certain maps, geological reports, etc. (Such reports and maps are retained on a confidential basis for one year, thereafter becoming available to all interested parties.) These show the results thereof, whereupon he may apply for a standard lease on lands totaling up to 50 percent of those originally reserved in each township, provided that tracts of such leased lands shall not exceed blocks of nine sections each in any one township. Thus, a lessee may acquire up to 50,000 acres out of an original "reservation" which covered 100,000 acres; but not more than nine sections, or 5760 acres, may be selected in any one township.

Adjoining each such lease block, the Crown (meaning the province) will reserve equal acreage, usually checkerboarded. In event of the ultimate success of the enterprise, such as the eventual discovery of oil or gas in commercial quantity, these lands so reserved will be put up for lease at public auction, wherein the lessee himself may bid against all comers; and, if thus successful, he may by this means secure a solid block. This may prove difficult in actual practice, as such proven lands usually are auctioned off in quarter-section units of 160 acres, each. This policy of checkerboarding lands reserved by the government has met with considerable criticism and resistance on the part of experienced oil operators, since it tends at the outset to defeat any program of unit operation and later on to promote wasteful competitive drilling. Not only that, but it allows late-comers—at a price—to participate in the fruits of costly pioneering and exploratory operations.

Standard oil and gas leases of the Department of Lands & Mines of the Province of Alberta are granted for a term of 21 years; and, upon application, may be extended for further periods of equal length. Thus, the producer of oil in commercial quantities acquires a vested right which endures as long as similar leasehold rights in the U. S.

Regulations provide for the granting of credits in amounts up to 50 per cent of expenditures approved by the Department of Lands & Mines in conducting the search for oil; and such credits may be applied to the first year's rental on any lands leased out of the "reservation" area. Thus, 50 percent of all approved geological, geophysical, and drilling costs may be applied as a credit against rentals during the first year of any lease contract. All other lease rentals are payable in cash at the rate of $1 per acre per year.

Upon discovery of oil, a producer may elect to pay royalty at the flat rate of 12½ percent, or upon a sliding scale under which his payments may range between 5 percent and 15 percent under an established formula which has been stated as follows:

"Crown Royalty on oil produced from Crown Land in Alberta is the square root of the average daily production for the month, with a minimum of 5 percent and a maximum of 15 percent, for the ten-year period beginning June 1, 1941; or, with the first return following a well coming into production a lessee may elect to pay on oil a royalty of 12½ percent until June 1, 1951.

"Royalty on natural gas is 15 percent of the selling price or fair value at the time and place of production, with a minimum of ¾ cent per 1000 cubic feet."

Clearing roads for oil development in Alberta.

Big Increase in Middle East Production

INCREASES in productions from the several producing countries of the Middle East continued to highlight the picture of world crude output toward the close of the year. The three largest producers of the Persian Gulf area showed a steady consolidation of their place as a major producer of crude oil, with the result that the area is approaching the Caribbean region in the daily volume of crude produced and moved into world markets.

The most outstanding increases during October were seen in the fields of Saudi Arabia and in Kuwait. The latter country, producing from the Burghan field alone, boosted its production to 191,695 barrels daily for October to compare with 160,266 barrels a day in September, and was moving rapidly toward its goal of 200,000 barrels a day before the end of the year. Already the wells of the field are capable of producing more than that amount, but handling and shipping facilities have not kept pace with the growth in potential output.

In Saudi Arabia production rose from 441,101 barrels daily in September to a new high of 468,727 barrels a day in October. In Saudi Arabia more than any other of the Middle East countries potential has been built up beyond the capacity of transportation facilities. The principal field at Abqaiq is producing the greater portion of the oil coming from that country and producing it without having all of its producing wells connected into the transportation system. On completion of the proposed pipe line to the Mediterranean it is quite apparent that this one field alone could produce enough to fill the line. In addition, a new field has been discovered at Ain Dar, west of Abqaiq, which might well prove to be the equal of the latter field. Other fields, at Abu Hadriya and at Qatif have received comparatively little development since work has been concentrated elsewhere.

Iran's production is likewise going up, with output during October averaging 561,074 barrels a day compared with 559,326 barrels daily during September. Here again the producing potential is more than adequate to fill all available channels of transportation. Anglo-Iranian Oil Company is rapidly expanding its tanker fleet to try to keep pace with demands for Iranian oil, and has a program to increase its total tonnage by more than 50 percent by the end of 1951.

Iraq's production is still constricted by having only the northern leg of its pipe line available for use, but nevertheless managed to increase its output during September, the latest for which official figures are available. During that month it produced 50,312 barrels a day, or 13,796 barrels a day more than in the previous month.

A slight increase was also registered in Egypt, which produced 35,440 barrels daily during October, or 1405 barrels a day more than September's average. The increases in the Sudr field on Sinai Peninsula are slightly more than balancing the decline from older fields. Sudr is now producing regularly more than 10,500 barrels daily, although on production only a year.

Despite predictions of rapid declines in Mexico, that nation has maintained its output at a high level all year. Its average over the past several months has been the highest in a number of years. Actually, the Mexican Gulf's properties accounted for the increases. An increased price in the Northern fields where the Gulf wells had been producing at rates of about 190 barrels daily have resulted in opening the wells to near capacity at about 1600 barrels daily. In the southern area Pemex bought Gulf's Toteco property in February and opened the wells from about 200 barrels daily to 800 barrels a day.

Total production from Canada showed a decline during the month of September, the latest total compilation by official sources, but reflected the cut in production from Leduc field during the time general field output was restricted while efforts were being made to control a wild well. Since then production has remained steadily above 40,000 barrels a day, and seems likely to increase in view of continued development and important new discoveries such as Redwater, which with its first three wells has proved an area thought sufficient to assure a reserve greater than Leduc's 200 million barrels.

In Venezuela, production by Creole Petroleum Corporation hovers around 650,000 barrels daily, and steady increases by Shell Group properties now have the two principal producers alone accounting for more than 1 million barrels a day. With other operators in the Mara area now entering the production picture, Venezuela's total output may be expected to pass 1,400,000 barrels a day before the end of the year.

Crude Oil Production

COUNTRY	COMPANY	PRODUCTION—In Barrels		
		Month	Barrels	Daily Average
‡Brazil	Conselho Nacional do Petroleo	September	11,888	396
		October	14,007	452
‡Canada	All Operators	September	1,100,714	36,691
Ecuador	Anglo-Ecuadoran Oilfields	October	138,680	4,474
	Ecuador Oilfields, Ltd.	October	356,780	11,509
‡Egypt	Anglo-Egyptian Oilfields	October*	1,240,386	35,440
France	All Operators	September	30,317	1,011
‡Iran	Anglo-Iranian Oil Company	October	17,393,292	561,074
‡Iraq	Iraq Petroleum Company	September	1,509,370	50,312
‡Kuwait	Kuwait Oil Company	October	5,942,553	191,695
‡Mexico	All Operators	July	5,073,465	163,660
		August	5,014,748	161,766
Peru	Lobitos Oilfields, Ltd.	October	194,790	6,284
‡Saudi Arabia	Arabian American Oil Co.	October	14,530,550	468,727
Trinidad	Apex (Trinidad) Oilfields	October	261,250	8,427
	Kern Trinidad Oilfields	October	38,498	1,242
	Trinidad Central Oilfields	October	45,029	1,454
	Trinidad Leaseholds, Ltd.	October	532,195	17,168
	Trinidad Pet. Dev. Co., Ltd.	October	222,139	7,166
	United British Oilfields	October*	516,979	14,771
Venezuela	Creole Pet. Corp.	September	19,615,770	653,859
		October	20,138,437	649,627
	Colon Development Co.	October*	391,640	12,635
		November†	300,929	10,747
	British Controlled Oilfields	October	40,431	1,304
	Ultramar Corporation	October	320,281	10,332
	Venezuelan Oil Concessions	October	11,490,156	370,650

‡ Complete Figures. * 5 Weeks Ending November 1. † 4 Weeks Ending November 29.

Western Canada Has Its First

DUAL OIL PRICES

FOR THE first time since Western Canada became an important producer of oil, secondary buyers of crude have refused to follow the posted prices of the largest single purchaser in the principal fields of Alberta. As a result, Leduc, Woodbend, Redwater and Turner Valley had two distinct scales of posted prices late in December, one of which ranged from 10 to 15 cents higher than the other.

British American Oil Company, Ltd., second largest purchaser, announced it would not follow completely the price reductions placed in effect by Imperial Oils, Ltd., and its subsidiaries early in December. The former is reducing prices in its posting, but remains 15 cents per barrel higher in Turner Valley and 10 cents higher in Leduc, Woodbend and Redwater. Under the present dual schedule of postings, British American is likely to pick up some connections from independent producers not bound by purchase contracts, but was forced into a general reduction in its previous postings through the adjustment that took place in refined products at the time Imperial announced its new crude oil postings. British American operates refineries in Calgary and Moose Jaw which together are processing about 12,000 barrels daily.

New Postings

Under the new schedule Imperial is paying a spread on gravity basis at Turner Valley ranging from $3.09 for 33-gravity with a 2-cent spread per degree to a top of $3.71 for 64-gravity oil, a reduction of 43 cents from the previous posting. British American's posting for the same gravity scale, effective December 4, ranged from $3.24 to a top of $3.86 per barrel.

At Leduc-Woodbend-Calmar the Imperia' posting is $2.95 flat (for 38-40 gravity oil) a reduction of 52 cents a barrel, and Redwater is posted at $2.68 per barrel. The British American set Leduc-Woodbend-Calmar at $3.05 per barrel, and Redwater at $2.78

In announcing its price reduction Imperial indicated that prices were being adjusted downward to a level competitive with imported oil for the entire prairie province area, and that resulting decreases in refined product prices were being passed immediately to the consumers of Alberta nad Saskatchewan. Officials of the company said: "The new Alberta well prices will permit Alberta production to compete successfully with present economic sources of U. S. crude wherever supplies from these sources impinge on the prairie market."

The previous prices had reflected in large measure the importation of crude oil at high cost from distant U. S. sources. It was hoped that this could be discontinued with rapid development of Leduc and Woodbend fields, and the promising outlook for the new Redwater area, which give prairie refineries assurance of adequate domestic supplies. It was expected that the new prices would continue in a more or less stabilized state until such time as the domestic producers would have to look to areas beyond the prairie provinces for a market, and it was not thought that export of crude from the area would have much further effect on crude prices, inasmuch as the new pipe line from Alberta to Regina would be ready to give low-cost transportation that far by 1950. This would materially reduce the cost of extending the market in competition with American oil.

Encouraging Independent

However, the action of British American in stabilizing its prices at a higher level than Imperial's may ultimately force a compromise schedule. In its official announcement of the price change, British American said: "The British American Oil Company is primarily engaged in the manufacture and distribution of petroleum products. From the inception of the company, the majority of its crude requirements has been purchased from independent producers. Therefore, British American realizes the importance of maintaining a price for the crude oil that will encourage the independent producer to continue his current high level of finding and producing additional oil which is so essential to the overall economic welfare of Canada.

"Faced with the sudden sharp reduction in the price of petroleum products recently posted in Alberta and Saskatchewan by a major competitive company, the British American, in order to enable its dealers and distributors to meet this competition finds itself with no alternative but to reduce the price it pays for crude oil in the areas affected by this price reduction of refined products."

Inasmuch as Alberta's oil production is increasing, and the marketing area must be extended to take care of increases in competition with other sources of supply, it is not expected that there will be any general increases in crude prices. Actually, British American reduced its prices in view of general existing conditions, but decided to remain above the level of competitive buyers in an effort to increase its connections.

The reduction in price of crude is being passed on to consumers in the prairie provinces in the form of reductions in posted tank wagon prices of gasoline, kerosine, tractor distillate and diesel fuels. Prices at Edmonton and Calgary as posted by Imperial are now identical since both have become refining centers, and represent reductions of 2.4 cents per gallon at Edmonton and 1.5 cents at Calgary. At other points in Alberta the reductions vary in accordance with differences in transportation costs from the refineries. At Regina, in Saskatchewan, reduction in gasoline price is 1.5 cents and 1 cent on other products. Prices outside the area vary with transportation distance.

Other Areas Affected

Imperial's new posting affects other areas in southern Alberta, most of which are tied in to the Turner Valley posting. Taber and Conrad field prices will automatically be cut by three-fifths of the Turner Valley reduction or about 25.8 cents per barrel. The new prices, loaded on cars at Taber, will probably be about $1.91 per barrel for East Taber's 18-gravity oil; $2.01 for West Taber's 22-23 gravity crude, and $2.05 to $2.07 per barrel for Conrad's 25-26 gravity oil. Princess and Bantry oils are also tied in with the Turner Valley postings with Princess Devonian oil at 33-gravity selling for about $3.09, Princess Madison oil at 23-25 gravity $2.52 to $2.57 per barrel, and Bantry's Lower Cretaceous 24-gravity, $2.42 per barrel. These prices are loaded on cars at Princess or Bantry.

Lloydminster's "black oil" prices are not affected by the reductions in lighter crudes since the principal products obtained from the 10 to 20-gravity oil are not affected by the changes in refined products prices. Current prices range from $1.25 for below 10 degrees with a 2-cent spread to 19.9 and above at $1.37.

Performance-Proven

POWER PLANTS

International Diesels are *performance-proven*. They have given remarkably dependable and economical service as the engines in International Diesel Crawler tractors. There just isn't any rougher work for an engine. Heavy loads, tough working conditions and long hours of operation all combine to give a crawler tractor engine a real going over.

Make no mistake about it. International Diesels are *performance proven*. You can be sure that you get full measure of profit-producing power from any International Diesel you select.

See your International Industrial Power Distributor or Dealer about your power requirements. He handles the full line of International Diesel and gasoline power units listed at the right.

He will be glad to help you select the right International Power Unit for your specific requirements. And you'll get the benefit of profit-producing power.

INTERNATIONAL ENGINES are available as complete power units in the following models:

DIESEL:	UD-24	180 h.p. @	1375 r.p.m.
	UD-18A	125 h.p. @	1600 r.p.m.
	UD-16	100 h.p. @	1800 r.p.m.
	UD-14A	76 h.p. @	1400 r.p.m.
	UD- 9	53 h.p. @	1500 r.p.m.
	UD- 6	39 h.p. @	1500 r.p.m.
GASOLINE:	U-9	55 h.p. @	1500 r.p.m.
	U-6	41 h.p. @	1500 r.p.m.
	U-4	31½ h.p. @	1800 r.p.m.
	U-2	22 h.p. @	1800 r.p.m.

Write for informative catalogs on International Power Units:

Form **A-54-LL**
INTERNATIONAL ENGINES AND POWER UNITS
Gas, Gasoline or Distillate

Form **A-251-LL**
INTERNATIONAL DIESEL ENGINES AND POWER UNITS

INTERNATIONAL HARVESTER COMPANY
180 N. Michigan Avenue, Chicago 1, Illinois

Listen to James Melton on "Harvest of Stars" every Wednesday evening—CBS

Standardize on Power that Pays

INTERNATIONAL
INDUSTRIAL POWER

CRAWLER TRACTORS
WHEEL TRACTORS
DIESEL ENGINES
POWER UNITS

Two More Discoveries for Canada's Alberta Province

Two new discoveries for southern Alberta in recent weeks will contribute strongly to the continuation of the exploratory activity in this Western Canada province. Early in December production had been assured in an area about 90 miles northeast of the city of Calgary in two wildcats drilled 16 miles apart.

Socony-Vacuum Exploration Company's Craigmyle 1 is an indicated oil discovery on the basis of a drill-stem test which flowed oil from a saturated section of the Madison limestone at 4050 feet. The well is eight miles north of the small town of Craigmyle, and was started as a deep test of all formations down to and including the Devonian. Operators apparently intend to carry out the original program, although the well has already assured production from the Madison, the formation from which the Turner Valley production comes. At the time of latest report it was going ahead below 4402 feet, and should have been down to the original objective by the first of the year.

The drill-stem test was opened with the tool at bottom of the hole. Fluid reached the surface in 18 minutes and it was allowed to flow for ten minutes before being closed in. Recovery in drill stem consisted of 1080 feet of gas-cut 34-gravity crude, and no formation water was recovered. A gas blow occurred when tool was opened, estimated at about 350,000 cubic feet daily. The interval tested was not reported, other than that total depth at the time of the test was 4050 feet.

The other December discovery was Hanna Pete 3, drilled by Hanna Petroleum's Ltd., 16 miles southeast of Socony-Vacuum's well and a mile southwest of the town of Hanna. A drill-stem test in this well at a depth of 3716 feet showed some gas and a recovery of 1680 feet of 24-25 gravity crude and no formation water. The oil is from the Sunburst sand which overlies the Madison Limestone, and about five feet of sand were taken in for the test. As in the case of the Socony-Vacuum operation, Hanna was to drill ahead to the Madison before making decision as to where the well will be completed.

The success of these two wells, coupled with the earlier history of exploration in the area, indicates that much more work will be done in the vicinity. Of only seven wells drilled in the general area to depths thought to be adequate, two have indicated that they will be oil discoveries, two others have been discoveries of gas-distillate areas, and three have been dry holes. Earlier this year Hanna Petroleum opened a wet gas area about midway between the two recent discoveries. The gasser was from the Sunburst section of lower Cretaceous. The other gas-distillate well was Berry Creek Petroleum's 1, east of Hanna 3, drilled to the Madison limestone early in 1947.

Sunray to Have Interest in Wildcat at Halfway Lake

Sunray Oil Company, which recently moved into Canadian operations and is one of the principals in the combination of indepents which has been obtaining considerable exploration acreage in Northern Alberta, will be associated with Pacific Petroleums, Ltd., and Atlantic Oil Company, Ltd., in drilling a wildcat at Halfway Lake.

Sunray will have one-half interest in this project. The well will be drilled on the strength of a recent gravity meter survey made by agreement with John C. Dallas, the original lessee. Location will be in 1sd 9 19-59-23w4th, about 18 miles northwest of Imperial's Redwater discovery.

Gaspe Ventures Has Showings In Eastern Canada Wildcat

Gaspe Oil Ventures, Ltd., has found showings of gas and dark green oil in its Venture 3 at 2297½ feet. Preparations were under way for a production test after the well cored ahead, and found showings on down to 2315 feet, with indications of water in the bottom of the zone just above 2335 feet.

This well indicates one of the first possibilities of opening commercial production in the Gaspe Peninsula region of Eastern Canada. The formation was scheduled for acid treatment before making the production tests. Just before finding this showing, a string of 8⅝-inch casing was run to 2016 feet and set with a hook wall packer to shut off water from formations above.

Stepouts Indicate Redwater Strike Will Equal Leduc

Redwater Field, opened in October by Imperial Oils, Ltd., is in process of rapid definition through the drilling of stepout wells, and shows promise of comparing in importance with Leduc, the 200 million barrel field 50 miles southwest.

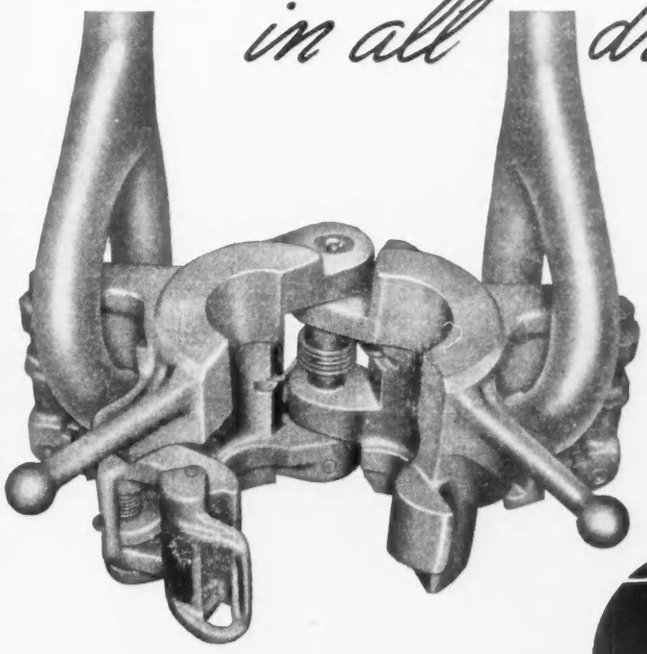
Although the second well, about five miles northeast of the discovery, apparently failed to find the coral reef condition existing in the discovery and was abandoned, two other wells, one about five miles northwest and another a similar distance southeast, found the Devonian limestone pay. This indicated that the field will be ten miles in areal extent in a northwest-southeast direction. Neither of the two stepout tests have been completed but Imperial Redwater 4 to the northwest found 80 feet of pay above water level. This is more than twice the section producing in the Leduc field, although less than 140-foot pay proved in the discovery well. Redwater 1 topped the pay, equivalent to the D3 at Leduc, at 3110 feet, or more than 2000 feet shallower than the formation is found in the older field, and showed an open flow potential of 1700 barrels a day after acidization. After coring the pay section, Redwater 4 was drilled ahead for structural information, stopping at 4476 feet before being plugged back to 3300 feet for completion.

On November 10 the Alberta government made its first offerings of Crown Reserve acreage near the Redwater discovery. A total of $1,037,000 was paid for four quarter-sections located two miles west of the discovery well and two miles south of the northwest extension. Anglo-Canadian Oil Company and Home Oil Company jointly purchased a half section and now have three rigs running. The other two tracts were bought by the team of Sunray Oil Corporation, Pacific Petroleums and Princess Petroleums, and a rig has started drilling. Seven rigs are now busy at Redwater, less than three months after discovery. Other bids have been submitted for Crown Reserve rights, but all but the ones mentioned above were rejected as being too low.

Of increasing importance is development in the new Lower Cretaceous area just northeast of Leduc opened by Continental Oil Company of Canada last August. Early in December five productive wells had been completed as quarter-mile stepouts with potentials ranging from 34 to 100 barrels an hour. The sands in the Cretaceous were found in these wells at 4100 to 4200 feet, and the 39-gravity crude was comparable to Devonian crude at Leduc and Woodbend. Continental is an independent firm headquartered in Calgary.

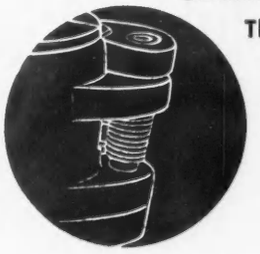
For GREATER EFFICIENCY *in all drilling operations*

WEB WILSON *Center Latch* ELEVATORS



AUTOMATIC SPRING OPENING—This spring automatically opens elevator when latch is opened—gives proper balance when elevator is open—automatically throws elevator away from pipe when latch is opened—eliminates cams, rollers and other unnecessary parts.

SLANTING HINGE PIN



This feature provides an automatic closing of the elevator as the load is applied—eliminates possibility of elevator not latching—minimizes load on latch when elevator is under strain.

SAFETY LATCH—Easily operated—one motion releases latch lock and opens latch. Latch lock closes automatically with latch when elevator is applied to pipe. Extremely strong, rugged construction—safety latch does not weaken latch or latch lug.

OTHER IMPORTANT FEATURES

Web Wilson Elevators are available in 100, 200 and 300 ton capacities for both collar and tapered type drill pipe. They are equipped with safety hand guards to protect the hands from the elevator links and are made of heat-treated manganese-molybdenum steel.

WEB WILSON Oil Tools INC.

WEB WILSON ELEVATOR "FIRSTS"

1. First to design an elevator for 18° taper pipe without the use of lifting plugs.
2. First to use automatic spring opening for center latch elevators.
3. First to use slanted hinge pin in center latch elevators for automatic closing.
4. First to use a latch lock which does not weaken the latching mechanism.

Huntington Park, California
Houston, Texas
New York City

It's a Wilson!

Germany's Exploration And Drilling Should Double

Success of the exploration and development program in Germany since the beginning of 1948 has been responsible for plans being laid by companies which should result in doubling exploration and drilling in the English and American zones during 1949. Much of the success enjoyed by operators in Germany has been in the Emsland area where production was increased 100 percent during 1948.

Plans announced by various operators indicate that promising areas throughout Northwestern Germany include the Aller-Weser River region, the Brunswick area, Oldenburg, Cuzhaven, Hamburg and Schleswig-Holstein areas. In many areas it is planned to drill wells to deeper formations than have been explored heretofore. At the same time it is planned to drill deep tests in the sub-Alpine areas of Bavaria and Swabia where geological investigation has indicated a number of favorable structural conditions. Those interested in a continuation of the prospecting include all of the principal German concerns in addition to those in which controlling interests are owned by American and British firms.

During the first nine months of 1948 total footage drilled in Germany amounted to 310,000 feet, of which more than a third, or 109,500 feet, was represented by wildcat drilling. Already the drilling footage has passed the 290,945 feet drilled in 1947, and according to current plans it is expected that 1949 drilling will reach a total of 980,000 feet of wildcats and 465,000 feet of production hole. This is an indication of the need for new reserves, showing the concern felt over the extent to which the many presently producing fields have been depleted under the urge of wartime necessity. It also reflects the optimism regarding possibility of finding the needed new producing areas. Of particular interest will be the results of the exploration in Bavaria and other parts of Germany where all showings to date have been of negligible importance to the overall economy.

Production Higher

Total crude production in Northwestern Germany and Baden during the first ten months of 1948 reached a total of 3,640,000 barrels, slightly higher than the 3,220,000 barrels produced in the corresponding period of 1947. Currently production is running ahead of the average for the year to date, since recent reports show the nation producing at a rate of 13,000 barrels a day, most of which is from the Northwest German area. The Baden area averages slightly more than 1000 barrels a day.

Meanwhile, imports of crude, diesel oil and bright stock into Germany's American and British zones increased to 3,163,000 barrels in the third quarter of 1948. This represents a 15 percent increase over the second quarter and an increase of almost 100 percent over the first quarter. The imports are proportionately larger as regards diesel oil, with receipts up 40 percent, while those of crude increased up 30 percent as compared with the second quarter. Imports of finished gasoline declined. Refineries in the British zone processed 486,000 barrels of crude oil imported from Venezuela and Saudi Arabia during the third quarter. British zone refineries delivered 1,469,000 barrels of petroleum products during the third quarter of the year as compared with 1,123,000 barrels in the preceding three months. Of the July-September total, 384,600 barrels were lubricants which showed a definite decline from the high of 143,700 barrels during the month of July. About 293,000 barrels were bitumen, 185,000 barrels diesel oil, which has shown a 100 percent increase during the year, and 229,600 barrels were motor fuel, light gasoline and liquid gas. Heating oil amounted to only 54,700 barrels during the quarter.

As of the end of 1948 it was estimated that the Shell Group's refinery installations at Harburg which had been almost entirely destroyed during the war, would be restored to the point where it can start operating by June or July of 1949. The plant is scheduled for processing of crude oil only.

During the next two years all petroleum facilities in the Northern German area of Rostock are to be substantially enlarged with an increase in the storage facilities to handle imports of gasoline and lubricants into the Russian zone.

Wildcat Is Best Producing Well In Southern France

Société Nationale des Pétroles d'Aquitaine has completed an exploratory well at Lalongue, near Lembeye in southwestern France on one of many structures outlined by surface geology and geophysics on its large concession. At latest report the well was making oil at the rate of 250 barrels daily. This is by far the best producing well completed in Southern France. Drilling in the area will continue until it is evaluated.

Meanwhile, additional outlet is promised for gas produced on the Régie Autónome de Pétrole concession at St. Marcet. Due to the inadequacy of the existing gas pipe line system from Peyrouzet to Toulouse to meet increased consumption, a second line was started late in 1947, designed to increase the capacity of the system from St. Marcet to Toulouse, and to extend the service as far as Bordeaux. The latter segment was started in April of 1948 and should be completed into Bordeaux by some time late in 1949. Current plans call for establishing service at various consuming centers as the construction of the line progresses. The 8-inch line will be 128 miles long.

Southeast Activity

Farther to the east, in the vicinity of the Rhone River, activity continues on the concession held by the Société Nationale des Pétroles du Languedoc Mediterranean (SNPLM) with reports of some encouragement. A wildcat being drilled in the extreme northern end of the grant has reported some heavy oil at a depth of around 2400 feet in the Oligocene. The well is being carried deeper and four horizons showing oil in fractured limestone have now been reported. It will go ahead, perhaps to basement, and plans are for a series of production tests at a later date.

To the south, SNPLM is operating two heavy drilling rigs at La Vaunage where gas had been reported in an earlier test. La Vaunage Wells 1 and 2 are both drilling at depths in the vicinity of 7500 feet and have another 900 to 1000 feet to go before reaching the point where the first well found gas. Four other rigs are at work on the concession on which a number of structures have been outlined by geophysical means.

Recently considerable interest has been shown in the eastern part of the SNPLM concession and in the Rhone delta area adjoining it on the east. The Régie Autónome de Pétrole has secured exploration rights on a large part of the Delta area and have started preliminary work. This is an area where the outcrops are hidden by recent sediments, and preliminary exploration will be through use of geophysical methods.

MARSH GAUGES

Under the grind
of daily service
Marsh Gauges
stand out
as the kind that
maintain
their accuracy.

JAS. P. MARSH CORPORATION
DEPT. K, SKOKIE, ILLINOIS

The Jas. P. Marsh line includes gauges especially designed for blenders, boilers, burners, capping, Christmas trees, columns, heaters, hydrogen units, instrument panels, pumps, Reid vapor bombs, scrubbers, separators, mud pumps, stills, towers, and other applications including oxygen and welding gauges.

Venezuela Assures Safety Of Foreign Oil Investors

More cooperative working arrangements are expected with the new Venezuelan government than were enjoyed by American oil companies under the regime of Romulo Gallegos, exiled president who was turned out of office by the Army. Gallegos blamed the oil companies for his ouster, but industry spokesmen denied that any company interfered in any way in Venezuelan political affairs. However, it was conceded that the incoming Venezuelan government may lift some of the restrictive measures sponsored by the Gallegos administration.

Dr. Pedro Ignacio Aguerrevere, new Venezuelan Minister of Development, has declared that until further notice there would be no change in oil policies or in the granting of concessions in Venezuela. He said many meritorious measures of the preceding regime would be continued, but that a definite oil policy would be formulated after study. The object of such a policy, he said, will be to stimulate the industry and provide the Venezuelan government with a fair share of profits. Referring specifically to foreign investments in Venezuela, Aguerrevere replied: "They are safe and sound."

Aguerrevere is a geologist and holds degrees from Stanford University and the Colorado School of Mines. He is well acquainted in the American petroleum industry.

Several American oil companies are declining to renew contracts for purchases of Venezuelan government royalty oil at premium prices, but this policy is said to reflect a gradual improvement in crude supplies and is not connected with any political developments. Present royalty contracts were negotiated last year at the peak of the shortage in the U. S. when Venezuela had high premium offers from foreign spot buyers. It is understood that Shell Oil Company has already notified Venezuela that it will no longer pay more than posted price of East-West Texas crude for Shell's royalty oil, which is about two million barrels a month. Gulf Oil Corporation likewise is not expected to renew a similar purchase contract. Creole Petroleum Corporation has a two-year royalty purchace contract which does not expire until November, 1949, while the Socony-Vacuum Oil Company contract also terminates about the same time.

The Portuguese firm of Sacor is understood to have offered a high of $2.28 a barrel for 50,000 barrels of Los Mercedes crude on a two-year contract.

Venezuela May Take Half Of Oil Companies' Profits

Legislation now under consideration in the Venezuelan Senate is expected finally to achieve the effect of a half-and-half division with the government of all profits made by the oil companies operating in that country.

When the petroleum law of 1943 was passed it had been understood that the government was to share alike with the companies in all profits. This was to be achieved by some form of taxation, plus an increase in royalty percentages.

However, due to fluctuations in the price of crude oil, as well as the increases in total production, it has been found that none of the income, normal and surtax formulae have sufficed to attain the objective. Excess profits taxes have been imposed from time to time to try to offset the difference.

The new legislation will make a 50-50 split mandatory regardless of the taxation and royalty payments by simply adjusting the payments to the state in accordance with the net income of the producer. Thus, if a company shows a net income of $100 million after taxes, and the government's income from the various royalties and taxes amounts to only $90 million, then the company simply will be required to pay an additional $5 million to the government so that each shows an income of $95 million.

The bill has already passed the House of Representatives, and is now in the Senate, where there is little doubt that it is being favorably received. Such legislation has been anticipated for some time by the principal producing companies. They knew that the intent of the government was to obtain as much income from oil as the producers, so they are for the most part prepared to pay the difference. A sliding scale of income brackets based on percent return on total invested capital will prevent working a hardship on operators whose production is still relatively small. Those with an annual net return of less than 10 percent of invested capital will not have to pay, while those with returns between 10 and 15 percent on invested capital will pay only one-half of the proposed levy.

Two U. S. Firms May Get Concessions in Ecuador

Negotiations are expected to be concluded shortly by, which Standard Oil Company (N. J.) and Shell Oil Company will acquire exploration and development concessions in Ecuador. A resolution was passed recently by the Ecuadorean congressional body empowering the president of Ecuador to grant such petroleum rights to the two companies, with the proviso that such a contract should follow the lines of the existing contract with Shell.

The Ecuadorean resolution embodies the following terms:

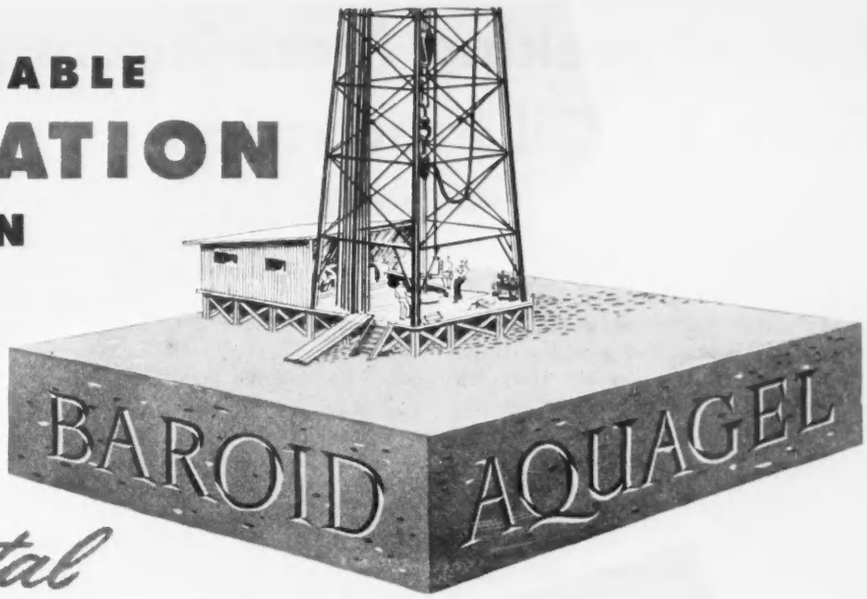
1. Petroleum development shall begin immediately following successful exploration, even if commercial distribution of the oil is postponed.
2. As soon as wells of adequate commercial capacity have been located, development therein cannot be suspended without Ecuadorean consent.
3. Any transfer of contract rights by the concession holders shall be made only in accordance with Ecuadorean law.
4. During the period of exploration, both Standard and Shell shall be committed to spend about $2¼ million a year each.
5. A central oil pipe line is to be built with a terminal at some point on the Ecuadorean coast adequate for shipping and export.

Turkey Production Reaches 1000 Barrels Per Day

In the Raman Dag area of southeastern Turkey it is now reported that production has been raised to approximately 1000 barrels daily. At the same time it is now reported that small quantities of home-produced petroleum products will soon be available for the local market with construction of a small refinery.

Several new rigs capable of drilling to depths of 6500 feet have been ordered in addition to the one now operating, but according to reports from Turkey, the Government agency has decided to halt general exploration, saying that they have already found more promising sites than can be developed for years.

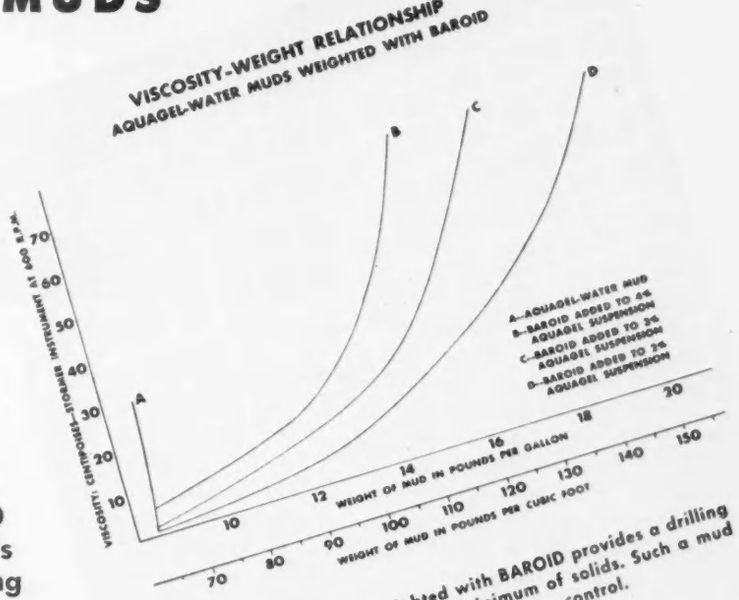
THE DEPENDABLE FOUNDATION FOR MODERN DRILLING



Fundamental TO ALL DRILLING MUDS

Many new and highly effective materials now make drilling muds better than ever before in solving troublesome problems. Baroid takes pride in having substantially contributed to the development of these materials. But, new methods, however spectacular, are nevertheless based upon fundamental concepts and technique.

Modern "know-how" combined with these two pioneer materials—BAROID and AQUAGEL—has resulted in muds capable of permitting straight drilling through most troublesome formations encountered, without highly critical control or maintenance. Such simple muds can readily handle the majority of drilling conditions easily and effectively. If conditions do demand special treatments or extremely low water losses, then Baroid-Aquagel muds provide a perfect base for such control.



An AQUAGEL-water mud weighted with BAROID provides a drilling fluid with maximum weight and a minimum of solids. Such a mud has a basically low water loss and is easy to control.

The drilling industry has long recognized BAROID as the standard mud weight material. The quantity annually consumed supports this fact conclusively. Similarly, thousands of operators prefer AQUAGEL to all other sources of colloidal material. These facts are a matter of record.

BAROID SALES DIVISION
NATIONAL LEAD COMPANY
LOS ANGELES 12 • TULSA 3 • HOUSTON 2

PATENT LICENSES unrestricted as to sources of supply of materials, but on royalty bases, will be granted to responsible oil companies and others desiring to practice the subject matter of any and/or all of United States Patent Numbers 2,041,086; 2,044,758; 2,064,936; 2,094,316; 2,119,829; 2,294,877; 2,387,694; 2,393,165; 2,393,173; 2,417,307 and further improvements thereof. Applications for licenses should be made to Los Angeles office.

Iraq Is Seeking More Income From Its Oil Production

Iraq Petroleum Company is negotiating with the Iraq government at Baghdad over demands that the company sharply step up its royalty payments and "liberalize" other provisions of the present contract. It is reported that the Iraqis are asking royalty increases from the present 21½ cents a barrel to nearly double that amount. So controversial are some of the issues, that one IPC official told WORLD OIL he expects negotiations to continue for six months before settlement is reached.

The Iraq government served notice on IPC and its two subsidiaries, Basrah Petroleum Company, Ltd., and Mosul Petroleum Company, Ltd., that existing contracts covering concessions be modified in the following respects:

1. That Iraqi nationals be allowed to participate in any new stock issue of IPC in accordance with the present clause of the contract which says that if new shares are offered for public subscription by the company, subscription lists shall be opened in Iraq at the same time they are opened in London or elsewhere, and that Iraqis shall have preference to the amount of 20 percent of such issues. It is Iraq's contention that wider distribution of share holdings among its nationals would contribute to the welfare of the Iraqi citizenry.

2. Royalty payments by IPC and its subsidiaries to be made in gold at free-market gold prices. IPC now pays royalties at the formal, British gold rate, with royalty fixed at four gold shillings a ton. When translated into sterling equivalent this works out at 21½ cents a barrel.

3. Larger petroleum production in Iraq. It is known that the Iraq government is dissatisfied with cutback production forced on the company by the closing of the south leg of the IPC pipe line from the Kirkuk fields to Haifa. Normally, Kirkuk production is around 90,000 barrels a day, but for the last few months only half of that amount has been produced. It is also said that Iraq asks for more intense exploration of other areas in the country.

4. Employment of large numbers of Iraqis in IPC's operations in the country. The government insists that an adequate training program should be maintained by the company, so that Iraqi nationals can be taught to fill many jobs now requiring foreign help.

H. H. Witley, assistant managing director of IPC, is heading negotiations for the company in Baghdad, nearest metropolitan point to the Kirkuk field. As the negotiations opened, Sayed Mohammed Al-Naquib, acting director of Iraq's Ministry of Economics, said that the most important issue of the talks was the finding of some formula by which Iraq could derive greater revenue from her oil production. He called attention to the fact that Iraq itself has prevented operation of the Haifa pipe line since last May to prevent the oil from falling into Israeli hands in Palestine.

In connection with Iraq's training demands on IPC, Al-Naqid also recalled that Basrah Petroleum Company had contracted with Iraq as far back as 1918 to train Iraqi nationals for technical work in their own country.

Gulf to Expand Facilities for Receiving Middle East Oil

Gulf Oil Corporation, with the rapid rise in its production from the Middle East, has announced that it will spend $40 million for plant expansion in the Philadelphia area for receiving and processing such crudes. The chief expenditure will be for extending refining and storage facilities in South Philadelphia, and long-range planning looks to an outlay of possibly $100 million in the area.

The greater part of Gulf's importations will be from Kuwait, at the head of the Persian Gulf, where it owns the Kuwait Oil Company jointly with Anglo-Iranian Oil Company. Crude oil production is rising rapidly from that area, having reached a daily average of 191,695 barrels during October, or more than three times the daily production from Kuwait at the beginning of 1948.

Gulf has acquired an additional 360 acres of ground in the South Philadelphia area, and has begun construction of facilities to increase the refinery's production from 77,000 to 107,000 barrels daily. The acreage taken by the company has doubled the present refinery and dock site. Docking facilities will be provided for five of the new 28,000-ton super tankers under construction.

The program, together with the expansion envisaged by several other companies, will make Philadelphia the second largest refining district in the United States, and the main port of entry for crude oil shipments from Kuwait. All of the major American operators in the Middle East are planning regular stepped-up shipments of Persian Gulf crude during the coming year.

Possibility of Adjustment In Anglo-Iranian Contract

Negotiations of extreme importance to Anglo-Iranian Oil Company's future operations in Iran are not proceeding too smoothly according to reports reaching here. The discussions have been carried on with a high degree of secrecy since the beginning of September and although both British and Persian authorities have refused comment, some idea has been gained from remarks attributed to responsible members of the Concession Department in Iran. One of the principal points of argument is apparently the extent to which Iran will share in the profits from production, refining and sale of Iranian oil.

The congressional body has refused to participate in the negotiations between Government and oil company delegates, demanding that the Government continue the discussion with the help of experts and advisers and submit the results in report form. This followed a request by the Premier to the Deputies that they nominate a committee to collaborate in the negotiatons. The Premier pointed out that they were being carried out within the limits of the powers accorded by law in 1947, from the time of the cancellation of the provisional agreement with Russia on the northern provinces. The law had enjoined the authorities to take steps to protect Iranian rights in every respect.

The Government desires cancellation of the terms of the agreement concluded in 1933, especially the section concerning the share in the profits and wants an increase in profits proportionate with the oil output.

An interesting point is the effect of the British Government's policy of limitation of dividends. The royalties received by the Iranian Government are partly related to the amount paid by Anglo-Iranian on its ordinary capital. In 1947 the company made a record profit of nearly $75 million, but under the dividend restriction plan it could not raise its dividend above the preceding year's 30 percent. The dividend being limited, and royalty payments restricted has led to some comment in the Iranian press.

Meanwhile the Government has instructed its representatives in France, Holland, Belgium, Sweden and Switzerland to prepare lists of experts in law, fianance and petroleum technology willing to go to Persia and advise the Government in its negotiations with the company.

A research committee has submitted a report on its investigations into the possibility of forming a national oil company, with particular emphasis on the possible drilling areas, prospective oil likely to be found and the method of disposition.

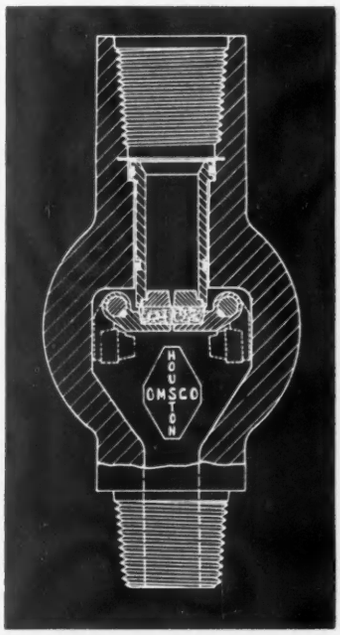
STOKVIS---LOOK! AND LISTEN!

OMSCO KELLY VALVE

No Freezing
No Sticking
No Lubricating

OMSCO Pressure Seal — The greater the pressure the tighter the seal

Valve complete with socket wrench.



Front cover plate removed.

OMSCO Kelly Valve **4½", 6⅝", 7⅝"** **T.P. 10,000#**

Rubber to metal seal.
Requires no lubrication.
Ample stock for recutting threads.
No friction areas to stick or freeze.
All wearable parts interchangeable between sizes.
Eliminates danger of bursting hose against closed valves.
Closed by hand; opened by pump pressure; locked open by hand.

Other OMSCO Pressure Seal Specialties

Drilling Safety Valve.	4½" T.J. (3" bore)	T.P. 10,000#
Wire Line Valve.	2½", 3", 4" bore	T.P. 6/10,000#
B.O.P.—Rods and Tubing.	2½", 3", 4" bore	T.P. 6/10,000#
B.O.P. and Master Gate	7", 10"	T.P. 6/10,000#

OILFIELD MACHINE & SUPPLY CO., HOUSTON, TEXAS

R S NEW YORK

EXPORT REPRESENTATIVES

R. S. STOKVIS & SONS, INC.

17 Battery Place

NEW YORK 4, N. Y.

Established 1844

R S NEW YORK

Fifth of Mexico's Oil Sold in Export Market

A report issued by Petroleos Mexicanos shows that exports of crude oil and petroleum products amounted to approximately one-fifth of total production during the first 10 months of 1948. Of approximately 50 million barrels of crude oil produced during this period, 10,433,796 barrels went into export. Production of crude oil has averaged slightly more than 5000 barrels a day greater so far in 1948 than the rate for the year 1947 which saw Mexico producing an overall average for the year of 153,782 barrels a day.

More than half of the total exports were in the form of heavy and light crudes amounting to 5,678,706 barrels, with fuel oil and gas oil next in that order. Fuel oil exports totaled 2,712,225 barrels and gas oil 1,347,986 barrels. Gasoline exports totaled 694,879 barrels, the greater part of which, 562,844 barrels went to the Dutch West Indies. The only other gasoline sold outside the country was to the United States which received 132,035 barrels during the first 10 months of the year. No exports of kerosenes, lubes or asphalts were listed.

The U. S. was the greatest importer of Mexican oil and products, receiving 4,659,196 barrels, mostly in the form of crude oil and fuel oil. Cuba was the second largest customer, having imported from Mexico 1,908,067 barrels, mostly in the form of fuel oil, although the total did include 711,927 barrels of heavy crude.

Other areas to which crude or products were exported by Mexico during this period were, in order of quantity received: Holland, England, Dutch West Indies, British West Indies, France, Belgium, Canada, China, Spain, and the Canary Islands.

Production Manager Named By Petroleos Mexicanos

Alfonso Barnetche has become manager of production for Petroleos Mexicano. He succeeds B. Fernandez y. Grajales, who has been given the important post of manager of new projects. Francisco Inguanzo has been made assistant manager of production, the position held until December 1 by Barnetche.

Barnetche takes to his new position much experience in exploration and production in both American and Mexican firms. He was the first graduate of the University of Mexico in petroleum engineering, holding also a degree as civil engineer from the same institution, graduating in 1935. After finishing his education he worked in Texas and Louisiana for 1½ years with Independent Exploration Company, and then returned to Mexico where he was with Sinclair Oil Company in the Poza Rica field, then joined the Mexican Oil Company (AGPN) until July, 1938, at which time he started with Pemex as a geologist; later as petroleum engineer, advancing to chief petroleum engineer and then assistant manager of production.

Barnetche's father was an engineer, and four of the five boys in the family are engineers. Three hold responsible positions with Pemex.

Canada's Oil Future Compared to Texas

A featured speaker at the meeting of the Interstate Oil Compact Commission at Wichita, Kansas, December 9-11 was N. E. Tanner, minister of lands and mines of the Province of Alberta, Canada, who reported that 18 American companies are currently operating in Alberta Province which has estimated reserves of over 4 trillion cubic feet of gas and perhaps 300 million barrels of oil reserves waiting to be explored as soon as it becomes economical to do so. He said that Canada is now in the same position as was Texas a few years ago and added: "With the improved methods of exploration, drilling and production, the picture should change rapidly."

German Production Highest in Three Years

Recent reports from Germany indicate that production for the month of October has reached a total of 410,100 barrels, the highest for any month since January of 1945. The extent to which the fields of the Emsland are becoming important is shown by the production of 122,500 barrels from that area, or about 7700 barrels more than in September. Meanwhile the fields of the Hanover and Schleswig-Holstein regions have just about maintained their producing rates.

Of interest currently is the news that the Military Government authorities have halted the dismantling of the rolling mill trains at the Rheinische Roehrenwerke and the Mannesmann-Roehrenwerke. The dismantling process had already begun, but has been halted so that the mills can again resume production of oil-country tubular goods. These plants are capable of turning out pipe of sizes from 6-inch to as large as 24 inches in diameter, and one of the plants has a tube broaching press which can manufacture pipe up to 32 inches in diameter. Both plants have received numerous export orders for oil field tubular goods which would take care of 90 percent of capacity. Much relief was felt in oil circles in Germany over the decision to allow the mills to continue, since the supply of pipe for the German oil industry was almost entirely dependent upon these two mills for its supply.

Santos-Sao Paulo Line Authorized by Brazil

The Brazilian Government has recently authorized the construction of a pipe line between Santos and Sao Paulo, to follow the same route as the Santos-Juniai Railway.

This will be a petroleum products line, 41 miles long with an initial capacity of 20,000 barrels daily, which is considered to be enough for the present needs of the city of Sao Paulo and its suburbs. As designed, it is expected that it will be possible later to increase the capacity of the line to as high as 100,000 barrels a day.

The line is under the jurisdiction of the National Petroleum Council, and concession has been granted for the construction to the "Estrada de Ferro Santo-Jundiai." Estimated cost for the project is 120 million Cruzeiros (approximately $7½ million).

In line with construction of other petroleum facilities in Brazil, it is understood that the Brazilians are preparing to start negotiations with the government of France with a view to liquidating its accumulated balance of francs through the purchase of refinery and railroad equipment. It is reported that the French are to furnish equipment for two small refineries, as well as more than a hundred small-sized locomotives built to Brazilian specifications.

Colombia Given Ninth Area With Commercial Production

With completion of the new pipe line connecting El Dificil field with Plato on the Magdalena River, the area becomes the ninth oil field to go on commercial production in Colombia. The line was completed late in August, connecting the field and the Andian National Company's pipe line with 48 miles of six-inch with initial capacity of 7000 barrels a day. The initial runs are at the rate of 3000 barrels a day, which may be increased as performance of the wells is observed under actual production conditions.

The discovery well at Dificil was drilled by the Shell Group in May, 1943, on a seismograph prospect, but under the terms of the concession agreement operators were allowed several years in which to complete development to the point where production potential was adjudged to be commercial in extent, and the exploitation period starts with the first shipments of oil. Throughout the early exploration stage of development the oil has averaged about 40 gravity, with most of the wells producing at fairly high gas-oil ratios, and a number of wells are thought to be capable of sustained production at rates as high as 1000 barrels daily each.

New Deep Wildcat Starts in Papua

The Australasian Petroleum Company (Proprietary Limited, is pushing its operations in Papua, in the southern pany (Proprietary Limited, is pushing soon should have three heavy rigs drilling deep exploratory tests. The company, in which ownership is held by British and American interests, together with the Island Exploration Company, holds large tracts of exclusive prospecting licenses both in Papua and in the Territory of New Guinea, and following abandonment early in 1948 of a deep test in Papua, is enlarging its investment and tripling its efforts to establish production.

Locations have been staked, following intensive geological work, for three new tests to prospect the Tertiary formations, and drilling commenced late in the year on Australasian's Oroi 1, the first to get started. This wildcat is situated about 50 miles northwest of the city of Port Moresby on a permit covering a total of 520 square miles. Simultaneously the construction of camp facilities, road building, and assembling of rigs is going on at two other locations more than 150 miles northwest of Port Moresby on the Vailala River, some 30 miles south of the deep test drilled earlier to a depth of 12,621 feet.

The acreage on which the operators hold prospecting permits, totals some 28,584 square miles in 10 separate licenses. The greater part, some 18,862 square miles, lies in Papua, along the southern coast and extending to the border of Dutch Guinea. The remainder is situated along the northern coastline of the Territory of New Guinea. All of the drilling has been on the acreage in Papua.

During 1947 the Petroleum Prospecting Ordinances of Papua had been amended to enable extension of the terms of prospecting permits from a period not exceeding one year, to a period not exceeding three years. At the same time provisions regarding the total term of any such permit were amended to allow any permit in force on February 11, 1942, to run for as much as 14 years. The 1938 laws had limited all terms to no more than 10 years.

Las Mercedes Region Has Steady Development

The Ultramar Company, which through its subsidiary, Caracas Petroleum S. A., holds a half interest in the Las Mercedes-Palacio fields of Central Venezuela, has announced that during the third quarter of 1948 a total of 15 producers and two dry holes had been drilled in the Las Mercedes and Palacio fields. At the same time two oil wells had been drilled in the new Guavinita field in addition to an outpost producer which extended that area more than a mile to the west. Two exploratory wells in the area have suspended operations.

In all the Mercedes company has four rigs running at Mercedes and Palacio on development and step-out drilling, one rig is drilling development wells at Guavinita, and another is drilling a new prospect to the north. During the quarter, production from the area amounted to 952,988 barrels, and the company is negotiating with the Government to allow such wells as are located on National Reserve acreage to be brought into production. Currently there are 11 such wells shut in. As of September 30, there were 79 wells actually producing.

Italian Petroleum Refiners And Importers Form Union

Italian petroleum refiners and importers have formed a Petroleum Union to deal with the various technical, economic, and financial problems connected with the return to normal peace-time market conditions in the oil industry. Large industrial groups formed with State support, groups allied to American companies, and private firms have all joined the union.

Arabian American Gets Lease On Building in New York City

Arabian American Oil Company has signed a long-term lease on a 21-story building at 505 Park Avenue, New York City. The deal, one of the largest of its kind in years in New York real estate, gives Aramco the entire building above the ground floor.

Aramco will consolidate all of its New York offices in the new building, and reports are that the company will transfer its headquarters from San Francisco to New York.

New Refinery to Be Erected In Northern Antwerpt, Belgium

Negotiations are proceeding for the erection of a new refinery in Belgium, jointly owned by L'Alliance, the local affiliate of the Anglo Iranian Oil Company, and the Petrofina Group. The plant, which is to be built in the northern part of Antwerp, is to have a throughput capacity of 25,000 barrels per day although no cost estimate is yet available. To enable the handling of crude on such a scale, new docking facilities for large tankers will have to be provided by the port authorities. It is hoped to complete the work in about three years.

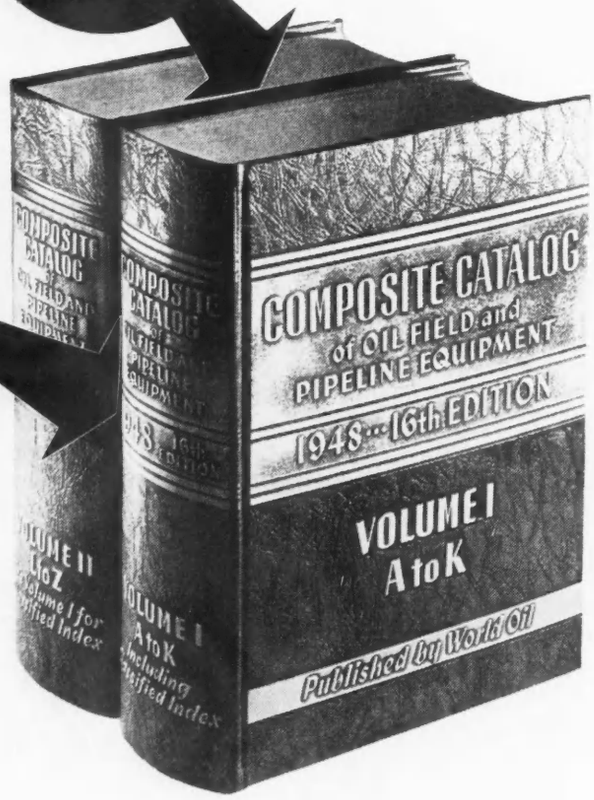
NOMAD VISITORS—A number of foreign visitors attended the December meeting of the Houston Chapter of Nomads. Those shown above are, left to right: Henry Shinouda, Anglo-Egyptian Oilfields, Cairo; Paul H. Derrick, Caribbean Petroleum Company, Maracaibo; Hassan M. Kamel, Anglo-Egyptian Oilfields, Ltd.; E. P. Hayes, representing Colombian Petroleum Company. Present but not in the photograph were: James Cooper, Ecuador Oilfields, Ltd., Guayaquil, Ecuador; Fredrico Gonzales, Corporacion de Fomento de la Produccion, Santiago, Chile; W. E. Boyd, Mene Grande Oil Company, San Tome, Venezuela; Van E. Morgan, Socony-Vacuum Oil Company of Colombia, Bogota.

An interesting program featured an illustrated talk by Gordon B. Nicholson of Houston Oil Field Material Company describing the methods by which a directionally drilled relief well killed the spectacular Atlantic wild well in the Leduc Field, Canada.

Save time! LOOK IT UP IN *Composite Catalog*

462 INDIVIDUAL COMPANY CATALOGS

MORE THAN 4,300 PAGES



By far the largest and most complete compilation of buying and specifying data ever published for the world-wide oil industry

The new 16th (1948) edition of Composite Catalog contains the complete or condensed catalogs on the products and services of most leading manufacturers selling to the drilling-producing-pipe line industry.

Because copies are always available "at both ends of the line" you will save time, avoid errors and speed operations by identifying each item by its page and figure number in The Composite Catalog.

USE THIS UNIVERSAL EQUIPMENT CODE!

COMPOSITE CATALOG

Published by WORLD OIL

NEW AND IMPROVED Equipment SUPPLEMENTING COMPOSITE CATALOG

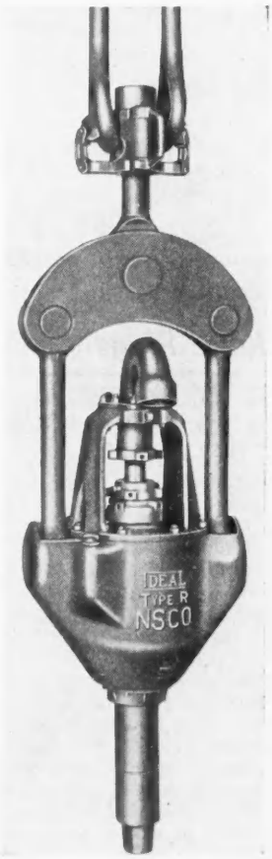
New and improved equipment of manufacturers who describe their products or services in the current Composite Catalog

1—Swivels

This item supplements The National Supply Company's data as shown on pages 2793-2892 of Composite Catalog.

Ideal Types RC and MC swivels are the Types R and M swivels with new connector-type bail. The new bails consist of two vertical links, a horizontal yoke and the elevator shank. The links are attached to the yoke and swivel body and the shank is connected to the yoke by pins which are in double shear. This construction guarantees complete load equalization and flexibility.

The unit ratings of these swivels are



200 tons for the RC and 250 tons for the MC.

For additional information write The National Supply Company, Box 899, Toledo 1, Ohio, *referring to* WORLD OIL *item* 1.

2—Heavy-Duty Hauler

This item supplements R. G. LeTourneau, Inc.'s, data as shown on pages 2270-2271 of Composite Catalog.

The Tournahauler is a vehicle designed to haul heavy length loads such as pipe, timber, steel, etc. It follows the LeTourneau tradition of incorporating operating characteristics that not only enable it to navigate the mire, sand and grades and sharp turns of off-road travel but also to travel on the highways. Features that make this possible are the Tournamatic torque proportioning differential; electric power steer permitting a full 90 degree turn of the Tournapull in relation to the rig; proper distribution of the load on both front and rear wheels, and the elimination of exposed springs and other vital assemblies under the frame that would drag when traveling through soft ground or become damaged by rocks or stumps.

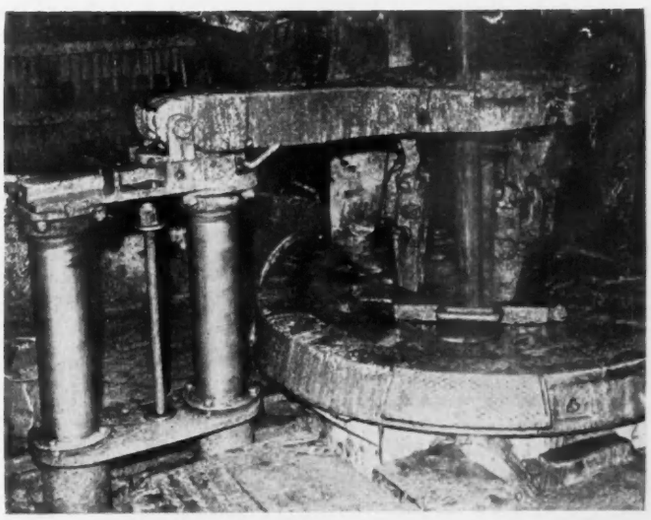
Tests showed that the Tournahauler can pull 26,000 pound pipe loads through mud conditions so severe that the rear wheel hubs were submerged.

Extra large, low-pressure tires afford the flotation that helps the Tournahauler get through.

For additional information, write R. G. LeTourneau, Inc., Longview, Texas, *referring to* WORLD OIL *item* 2.

3—Power Slips

This item supplements Byron Jackson Company's data as shown on pages 797-896 of Composite Catalog.



Speed trip power slips are pressure-set as well as pressure-raised by controls at the driller's post. With pressure-setting it is possible to get positive centering of the drill pipe, tubing or casing.

The driller is in full control of the operation of the power slips. The capacity of the new power slips is limited only by the bearing capacity of the rotary table. All drill pipe, tubing or casing in all sizes from 2⅜ to 7 inches may be handled by proper-sized slip bushings.

Air power is recommended for simplicity and efficiency. Recommended compressor capacity should provide at least 16 cubic feet minimum capacity at 120 pounds per square inch.

For additional information write Byron Jackson Company, 2300-2301 East Vernon, Los Angeles 54, *referring to* WORLD OIL *item* 3.

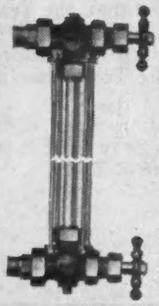
PENBERTHY
Liquid Level GAGES

REFLEX

Reflex type complete with gage valves. Liquid shows black—empty space shows white. Liquid level is always unmistakable.

TRANSPARENT

Transparent type complete with gage valves. Used where through vision is desired under high pressures and/or temperatures.

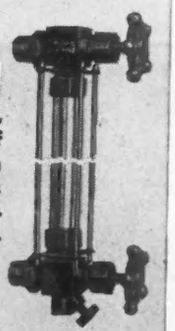


DROP FORGED STEEL

Tubular glass type, Chrome-Moly temperature resisting steel body, stainless steel trim, regrinding removable seats.

ALL IRON

Tubular glass type, extra heavy body of special high strength alloy iron, shanks alloy steel, trim stainless steel, valves self-cleaning.



There is a Penberthy Gage of superior quality for every liquid level gage requirement. Gages are fabricated to customer's specifications from special alloys to meet unusual corrosive and temperature conditions. All Penberthy Gages conform with API-ASME requirements.

3277-B

PENBERTHY PRODUCTS

PENBERTHY INJECTOR CO.

Detroit 2, Mich.

Canadian Plant — Windsor, Ontario

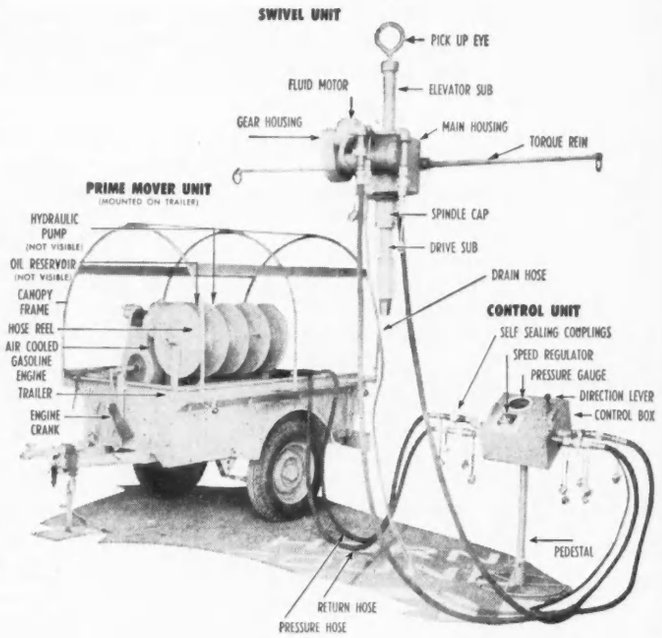
NEW EQUIPMENT

SUPPLEMENTING COMPOSITE CATALOG

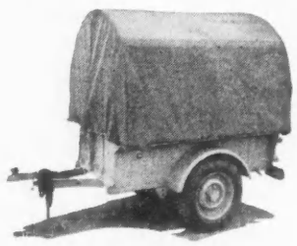
4—Power Swivel

This item supplements Bowen Company of Texas' data as shown on pages 685-716 of Composite Catalog.

Bowen power swivels are used for all types of light rotary operations because they eliminate the necessity of moving in kellies, rotary tables, or other heavy equipment for light, short-time rotary work, and because they eliminate the inefficiency and even danger of rotating strings by hand. They provide the driving power for internal cutting of casing, drill pipe and tubing; for drilling out cement following squeeze jobs; for backing scraping liners.



BOWEN POWER SWIVEL



The power swivels consist essentially of a prime mover unit, a control unit and a swivel unit combined by hydraulic hoses. The prime mover unit consists of an air-cooled gasoline engine coupled through a gear reduction to a hydraulic pump, both mounted above an oil reservoir. The hydraulic pump is provided with a relief valve to protect the entire assembly from overloading. The control unit consists of a pedestal and a control box within which are a direction lever, a speed regulator, and a pressure gauge. The swivel unit consists of a fluid motor coupled through gear reductions to a drive sub. An elevator sub is provided so that the unit may be easily suspended in the derrick. The hoses are in 50-foot lengths to permit operation of the swivel unit high in the derrick and to permit location of the gasoline engine at a safe distance from any danger area.

The swivels are available in two types. Type B has a constant gear reduction between the fluid motor and the drive sub and is designed primarily to provide the power for the internal cutting and other light duty rotary operations. Type C has a two speed gear shift and is provided with a more powerful gasoline engine and more powerful hydraulic equipment and is designed to perform medium duty rotary operations as well as internal cutting.

For additional information, write Bowen Company of Texas, P. O. Box 1025, Houston 1, *referring to* WORLD OIL *item* 4.

5—Soluble Plugs

This item supplements Kobe, Inc., data as shown on pages 2145-2164 of Composite Catalog.

A three-inch soluble plug for use in cleaning paraffin out of surface production lines is available in 1-, 1¼-, 2-, 2½- and 3-inch sizes.

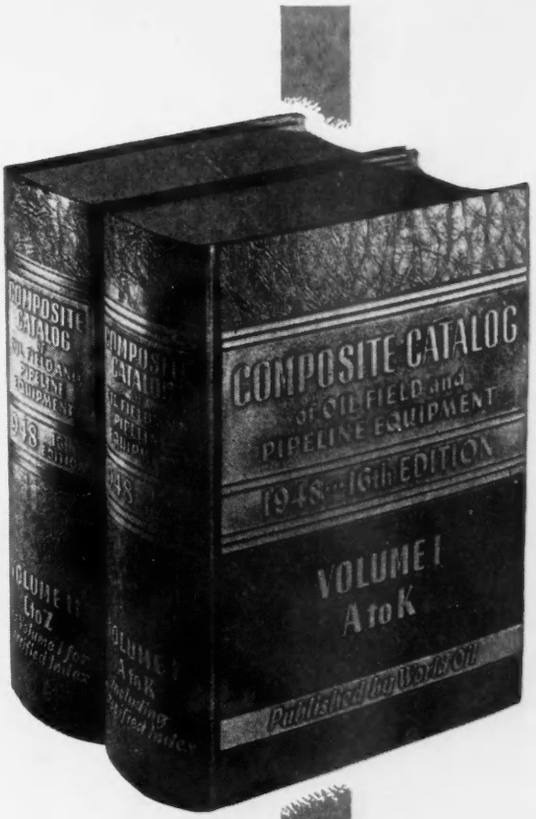
The manufacture of the king-size plug is the result of an industry-wide demand for an inexpensive and simple soluble "go-devil" for use in surface lines.

All that is required, when paraffin forms in a line, is to insert a plug and push it through the line with oil pressure. Kobe plugs have sufficient rigidity to scrape the wax off the walls of the pipe fittings. It is not necessary to retrieve the plugs that are inserted in the line. They are designed to dissolve after a short period of submergence in oil.

On leases where wells are not hydraulically operated, it is necessary to develop a method by which pressure can be placed behind the plug with sufficient force to push it through the line.

For additional information write Kobe, Inc., 3040 East Slauson Avenue, Huntington Park, Calif., *referring to* WORLD OIL *item* 5.

In HERE are 36 PAGES ABOUT The most ECONOMICAL DRILLING RIGS and SERVICING UNITS MADE



Yes! THEY'RE FRANKS MFG. CORP. WELL SERVICING AND DRILLING UNITS

See pages 1334 to 1368 of the Composite Catalog for descriptions of features and specifications of Franks Drilling Rigs and Servicing Units. Franks pioneered these essentials of drilling and servicing economy:

1. Faster rig-up and rig-down.
2. Faster location-to-location moving.
3. 100 per cent portable units on wheels.
4. More portable skid units.
5. Quality, longer lasting equipment with less maintenance and repair.

These features are paramount in Franks equipment. Investigate before you buy. If the Composite Catalog does not contain all the information you desire, call Franks nearest office or a stock distributor.

FRANKS MANUFACTURING CORP.

FRANKS SALES AND SERVICE:

Main Office: Box 3218, Tulsa, Oklahoma. **California:** Compton, 909 Alameda Street. **Illinois:** Mt. Vernon, 1400 Salem Road. **Kansas:** Great Bend, 10th and Lincoln Streets. **Texas:** Alice, North Highway 281; Amarillo, 2123 S. Tyler; Houston, 320 Bankers Mortgage Building; Kilgore, 1800 Longview Avenue; Odessa, 2316 Kermit Highway. **Export Office:** 149 Broadway, New York, N. Y.

Franks Units NOW Stocked By:

Bovaird Supply Co. Houston Oil Field Material Co. Jones and Laughlin Supply Co.

FRANKS MFG. CORP. WELL SERVICING AND DRILLING UNITS TULSA, OKLAHOMA

NEW EQUIPMENT

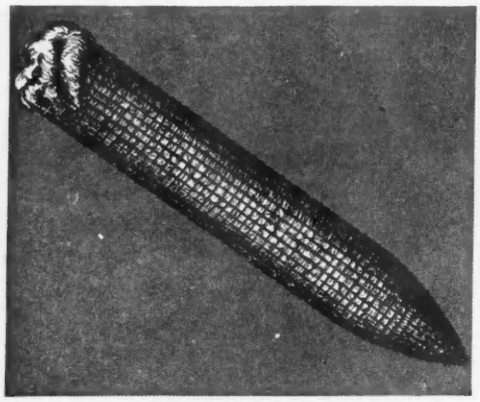
SUPPLEMENTING COMPOSITE CATALOG

6—Tubing Elevator

This item supplements Regan Forge & Engineering Company's data as shown on pages 3661-3684 of Composite Catalog.

A tubing elevator with a double safety feature has been designed so that even when the door is not locked, a positive-acting safety latch, which rotates with the lock, keeps the tubing locked within the elevator. Thus, the tubing can never drop even though the door is open. The regular door lock has double locking faces, and the body is a heat treated alloy steel casting. Produced under the name of Regan Dualock Tubing Elevator, they have been pre-tested under every field condition.

For additional information write Regan Forge and Engineering Company, P. O. Box 150, San Pedro, Calif., *referring to* WORLD OIL *item* 6.



Don't risk Bottom Water shutdowns

Eagle-Picher Lead Wool

shuts out Bottom Water!

Prevent costly shutdowns, keep bottom water out of your wells with effective, economical Eagle-Picher Lead Wool. The fine, durable strands fill cracks and crevices with a permanent, non-corrosive seal...save you time and money. Packed in convenient 50-pound sacks — easy to place in special cartridge-shaped Eagle-Picher Wire Containers sized to fit all casings. Order through your jobber today!

These 3 Eagle-Picher Bearing Metals meet most requirements

Dreadnaught — for extreme speed and heavy-duty conditions.

Outlasta — for medium speed and average-load conditions.

Durable—for low speed and light-duty conditions.

EAGLE-PICHER LEAD WOOL

Seals off Bottom Water— keeps 'em flowing!

THE EAGLE-PICHER COMPANY

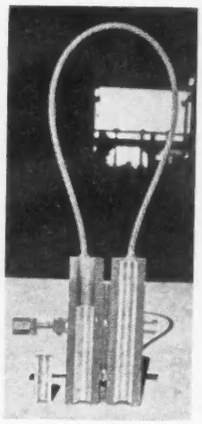
EAGLE Since EP PICHER 1843

Cincinnati • East St. Louis
Chicago • Kansas City • Dallas

7—Wire Line Tightener

This item supplements Sunshine Iron Works' data as shown on pages 4000-4003 of Composite Catalog.

The Sunshine Iron Works line tightener is a new and improved time and accident saver. It is of simplified clamp design, with two-hinged half-shells. These shells house interchangeable brass liners through which the drilling line passes as it is being spooled. As a safety device, it eliminates the use of the catline while spooling the line after a cut is made. As a time saver, it permits free and easy drum spooling of the line. Strung free from the derrick a few feet above the drum, the SIW line tightener swings back and forth as line is spooled onto the drum, preventing overlap and kinking.



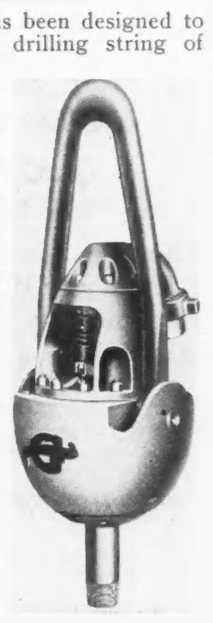
Clamps are 18 inches long and weigh approximately 68 pounds. An adjustable hasp permits quick opening and closing of the halves, and a two foot, hip-high cable loop serves as an easy means of swinging it in the derrick.

For additional information write Sunshine Iron Works, Odessa, Texas, *referring to* WORLD OIL *item* 7.

8—Swivel

This item supplements The Guiberson Corporation's data as shown on pages 1497-1548 of Composite Catalog.

A 45-ton swivel has been designed to complete a unitized drilling string of Guiberson tools. Outstanding in the new swivel is its packing design. The washpipe is full-floating, rotating between two independent packing glands. This arrangement is said to cut wear on the washpipe in half because rotation is in either or both packings.



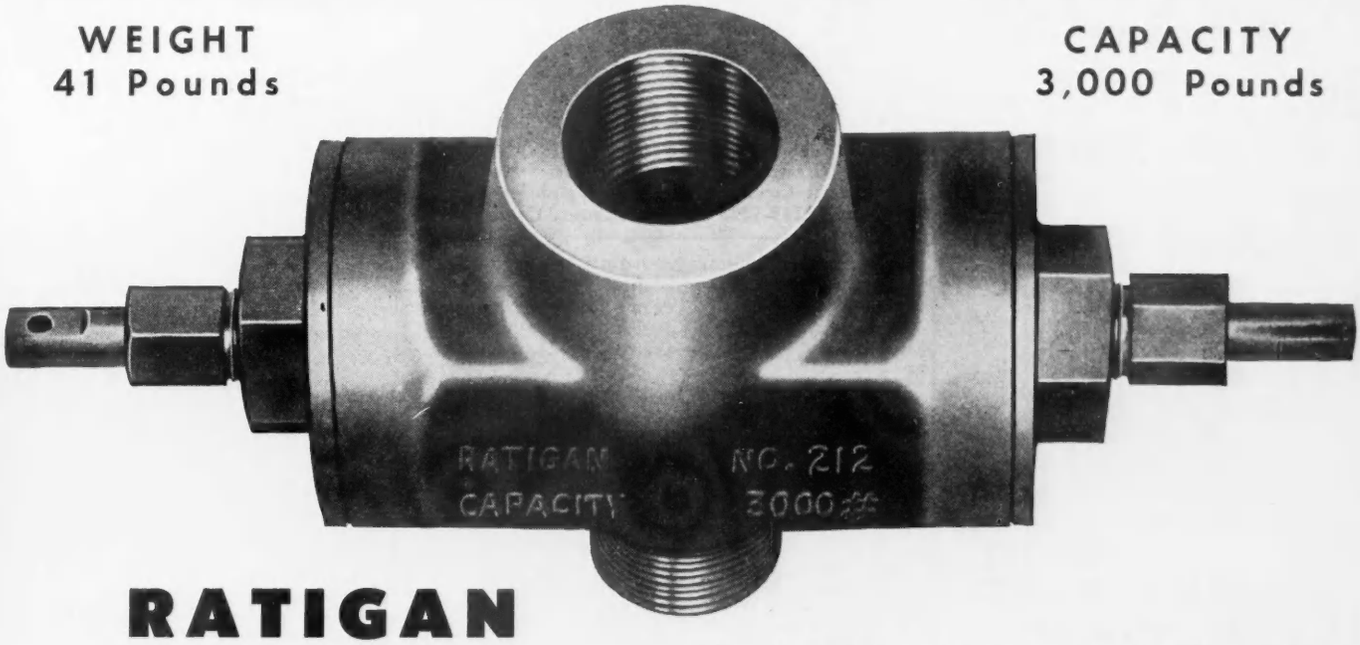
Engineered to meet the heaviest demands of drilling operations within its weight range, the swivel is constructed with heavy duty full-size roller bearings turning in a circulating oil bath. The fluid passage in the gooseneck, washpipe, and spindle is extra-large.

For additional information, write The Guiberson Corporation, Dallas, Texas *referring to* WORLD OIL *item* 8.

Greater Safety • Maximum Efficiency • Utmost Economy

WEIGHT
41 Pounds

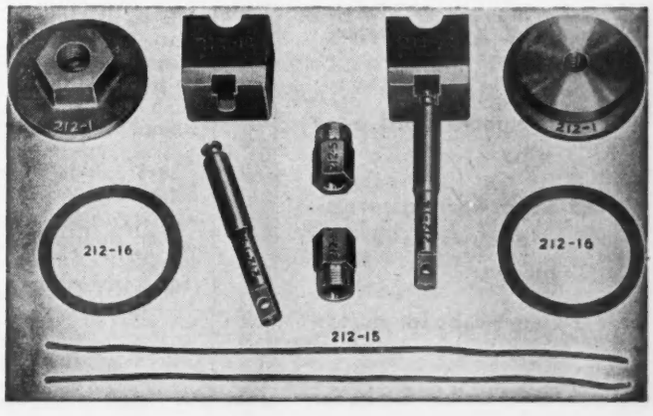
CAPACITY
3,000 Pounds



RATIGAN No. 212 BLOWOUT PREVENTER

The Ratigan No. 212 Blowout Preventer is carefully engineered for maximum safety and convenience in operation. It is a new, improved unit with new type retractable rubbers which can be changed more rapidly . . . . to change rubbers it is only necessary to unscrew the plugs at each end. (Refer to parts illustration–right.) The Ratigan Blowout Preventer can also be used for swabbing or running rods in wells that head or flow in the course of operation.

The Ratigan No. 212 Blowout Preventer is manufactured in 2½" and 3" sizes. The 2½" size is supplied both plain and upset. The 2½" plain can be furnished in double female, but if male and female are required, a short nipple can be used to accomplish this. The 2½" upset can be made in male and female or double female. The 3" size is supplied male and female only; however, the male connection easily can be converted to female by installing a 3" collar, thus making a double-female unit. Two of these blowout preventers of the same size, with a nipple of any required length in between make a very efficient unit for swabbing.



Refer to the Composite Catalog for details of Ratigan Sure-Grip Products, and write us direct regarding your special requirements.

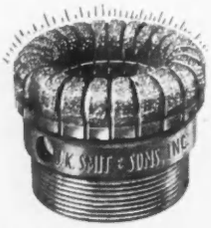
J. P. RATIGAN, INC.

1213 Santa Fe Avenue, Los Angeles 21, California

Ratigan Products are Distributed Through Leading Supply Stores

DIAMOND CORING

brings...
✓ SPEEDIER PENETRATION
and...
✓ GREATER RECOVERIES



✓ DIAMOND CORE BITS ...for sale
✓ SPECIAL CORE BARRELS for rent or sale
✓ SERVICE ENGINEERS

DIAMOND OIL WELL DRILLING COMPANY
MIDLAND, TEXAS
815 MIDLAND TOWER PHONE 2710
OKLAHOMA CITY, OKLA.
208 SW 44TH ST. PHONE 62-1538

Bell TUBING SWABS

The New Standard for Efficiency and Economy

- Lift more fluid each trip.
- Long wearing reversible cups save you money.

2-Cup Swabs for shallow work.

4-Cup Flexible Swabs for deep swabbing.

See Pages 2642-43 Composite Catalog
Patent #2,317,433

MECHANICAL MANUFACTURING CO., INC.
BOX 1001 PHONE 4-3261
FORT WORTH, TEXAS
EXPORT: BROWN & BECKLEY
30 Rockefeller Plaza, New York

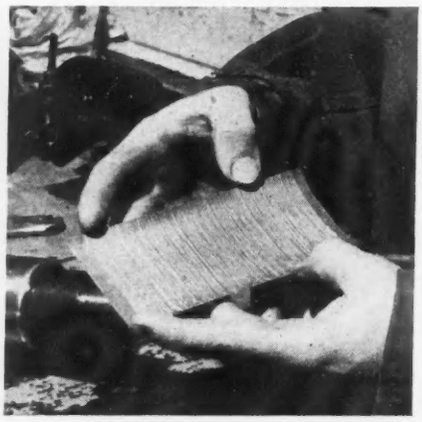
NEW EQUIPMENT

SUPPLEMENTING COMPOSITE CATALOG

9—Recording Chart

This item supplements the Otis Pressure Control Company, Inc., data as shown on pages 3265-3296 of The Composite Catalog.

A coated metal recording chart, for use in meters and recording instruments, operates under extreme temperature, pressure, and other adverse physical conditions. It will not shrink, expand, deteriorate, or become deformed under atmospheric changes or by coming in contact with moisture, hydrocarbons, or corrosive elements; nor will the patented coated surface crack, peel, or flake, under these same conditions. The coated surface is extremely sensitive to very light stylus or dry pen. Constant or erratic stylus movements can be recorded in a fine solid line, consistent in width.



The charts are now being manufactured and used in thicknesses of .002 to .003 inch, and can be made as thin as .001 to .0015 inch, if desired. The chart material, available in blank face without measurement or division markings, can be trimmed to close tolerances and fitted flush into the working parts of an instrument or meter.

The Otis Coated Metal Recording Chart can be made in roll, strips, circular, and various shapes for use in various types of recording instruments.

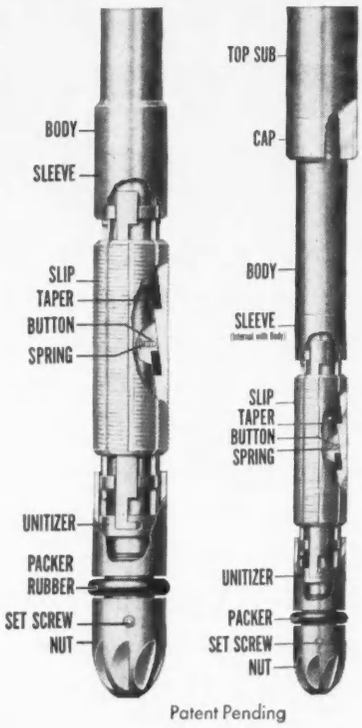
For additional information write Otis Pressure Control, Inc., Box 7206, Dallas, Texas, *referring to* WORLD OIL *item* 9.

10—Releasing and Circulating Spears

This item supplements S. R. Bowen Company data as shown on pages 653-684 of Composite Catalog.

Series "D" Bowen releasing spears utilize novel full circle slips that contact virtually the entire inner surface of a long section of the fish and in addition the entire inner circumference of the full circle slips are backed by tapers on the spear body. As their primary releasing mechanism Series "D" spears provide means for hanging and supporting the full circle slips in their uppermost

BOWEN SERIES "D" RELEASING AND CIRCULATING



Patent Pending

PELCO
Welding Saddles
Specify PELCO
IMMEDIATE DELIVERY
OUTLET (OR NOZZLE) SIZES ¼" TO 16"
HEADER (OR LINE) SIZES UP TO 36"
Order Through Your Favorite Supply House
PELICAN WELL TOOL & SUPPLY CO.
P. O. Drawer 1108 Shreveport (84), La.

Twin Disc Clutches *on this job, too!*

Twin Disc Model CL Clutch.

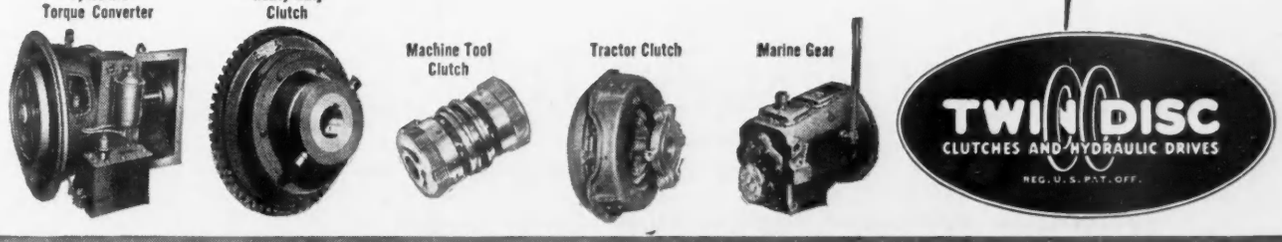
There are four Twin Disc Model CL Clutches in the Winter-Weiss Portadrill transfer case. The Portadrill is used mainly for exploratory drilling and shallow oil production.

Exploratory drilling calls for speed . . . portable rigs that must move fast and drill fast.

Fast drilling demands a fast-acting clutch . . . like Twin Disc's Model CL. The CL is a heavy-duty friction clutch, yet small and compact . . . designed for high-speed installations demanding easy engagement and disengagement.

Overall dimensions are held to a minimum to conserve space. Action parts are hardened and ground. Wide friction surfaces are used. High grade molded asbestos friction material and highly finished surfaces on the clutch plates reduce wear to a minimum and assure smooth positive operation.

Twin Disc Model CL Clutches are available in one, two and three plate models, 5.5″ to 11.5″, with working capacities ranging from 12 to 125 hp. For complete information, write for Bulletin 120-C. TWIN DISC CLUTCH COMPANY, Racine, Wisconsin (Hydraulic Division, Rockford, Illinois).



SPECIALISTS IN INDUSTRIAL CLUTCHES SINCE 1918

position relative to the spear body. When in this position, the full circle slips cannot be expanded against the fish by tapers on the spear body, and the spear can be easily withdrawn from the fish. As a secondary releasing mechanism, lefthand wickers are cut on the full circle slips to permit unscrewing from the fish. The new spears can be engaged with and released from a fish indefinitely without being withdrawn from the hole.

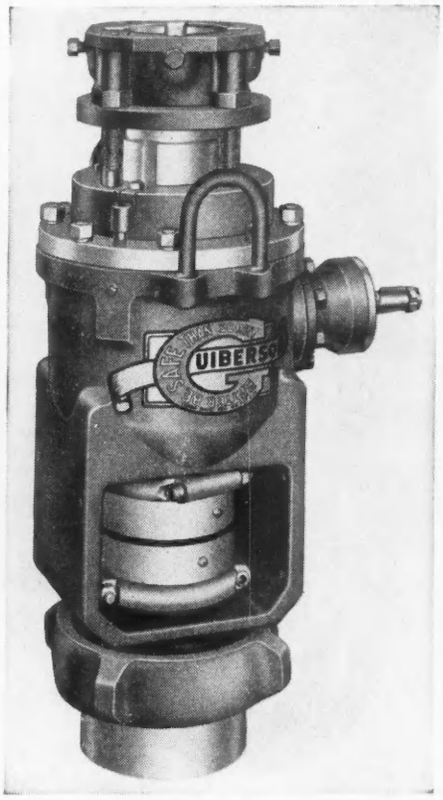
All Series "D" spears in drill pipe and tubing sizes are provided with skirt threads for installation of skirts and oversize guides when such accessories are necessary to insure alignment of the spear with the fish.

For additional information write S. R. Bowen Company, Santa Fe Springs, Calif., *referring to* WORLD OIL *item* 10.

11—Rotating Drilling Head

This item supplements the Guiberson Corporation's data as shown on pages 1497-1548 of the Composite Catalog.

A new rotating drilling head, labeled the Type "J" drilling head contains a newly designed wash-pipe packing assembly. The wash-pipe, full-floating in its action, rotates in either or both of



two independent packing glands. This wash-pipe packing assembly is said to be completely tamper-proof.

Each new Type "J" drilling head is available with a spare assembly. When the original becomes worn, the operator can merely replace it with this standby and send the worn part to the Guiberson plant. The company will immediately return a "factory new" spare to the operator enabling him always to be prepared for replacements, and will then completely renovate the returned assembly, replacing all worn parts.

The Type "J" drilling head is built with studs 25 percent heavier than other Guiberson models and is reinforced for increased load carrying capacity. It is constructed to handle tubing strings up to 8000 feet, in 2½- and 3-inch sizes. Mud and fluids are prevented from entering the housing, because the accordion-shaped packing rubber contained in the head gives positive seal around the tubing and around square, hexagonal, or octagonal kellys.

For additional information write Guiberson Corporation, P. O. Box 1106, Dallas, Texas, *referring to* WORLD OIL *item* 11.

PARKERSBURG MACHINE Co
PARMACO
PARKERSBURG, W. VA., U.S.A.

The House of Courteous Service

BEGINNING
49 YEARS
OF SERVICE TO
THE OIL INDUSTRY
and Today as of Yesteryear

PARMACO
MEANS QUALITY PRODUCTS

ASK YOUR FAVORITE SUPPLY
HOUSE FOR PARMACO PRODUCTS

PARKERSBURG MACHINE CO.
PARKERSBURG, WEST VIRGINIA

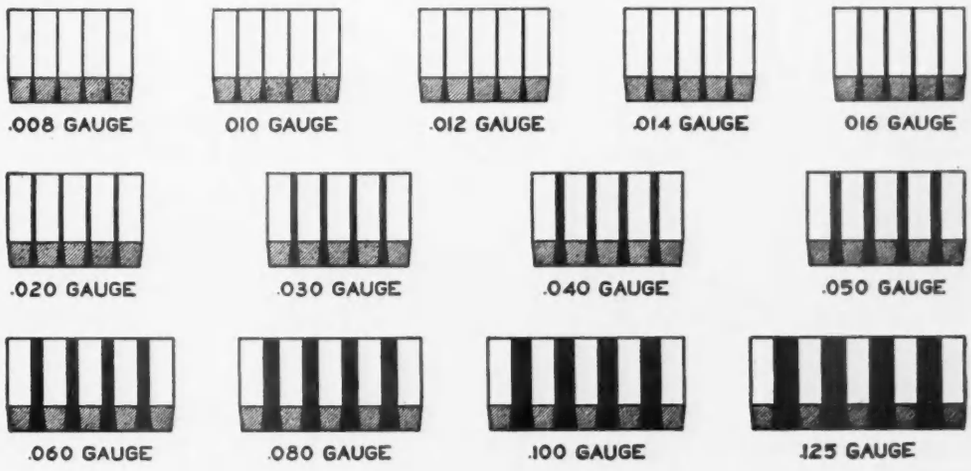
Exclusive Export Distributor
PETROLEUM MACHINERY CORPORATION
30 Rockefeller Plaza, New York 20, N. Y.

THE LAYNE

wire wrapped SCREEN

Available in "Your Choice" of Gauge Opening

Milled Groove



The black lines represent the spaces between the wires. Shaded portions show shape and size of wires.

In the Layne Wire Wrapped Screen, you can get the gauge opening best suited to your sand problem. The Screen is wrapped to any gauge desired. The table above gives an idea of the actual size of opening in various gauges.

Layne Wire Wrapped Screen offers a choice of Galvanized Steel Wire; Admiralty Brass Wire; Commercial Bronze Wire, and 18-8 Stainless Steel Wire, all the same dimensions, drawn and annealed to our specifications, with strength and toughness to withstand abrasion, yet ductile enough to permit wrapping on the pipe.

The Wire is a flat bottom semi-V shape, so when wrapped on the pipe, produces an inverted opening of the same shape that flares towards the openings in the pipe. This semi-V shape opening resists clogging as it offers a freer passageway for the fluid after it leaves the screening point of the wires. Anything passing the screening point will be pumped out.

"WHEN YOU USE A LAYNE SCREEN—YOU ARE USING THE BEST"

●

THE LAYNE AND BOWLER COMPANY

EXPORT:
Jeff Tucker
Room 1636
30 Rockefeller Plaza
New York, N. Y.

General Office & Factory

8000 Market Street **Houston, Texas**

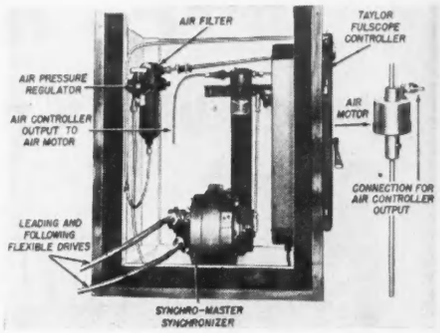
WEST COAST:
Layne & Bowler Corp.,
900 Santa Fe Ave.,
Los Angeles, Cal.

OTHER NEW AND IMPROVED *Equipment*

12—Synchronizer

The Synchro-Master synchronizer and phase controller is designed to provide automatic and continuous synchronization of the rotative speeds of any number of independent engines and to hold their crankshafts in any desired phase or angular relationship regardless of relative changes in load. These control effects are accomplished by a differential synchronizer operating through an air serve system connected to the fuel valve linkage of each engine being controlled.

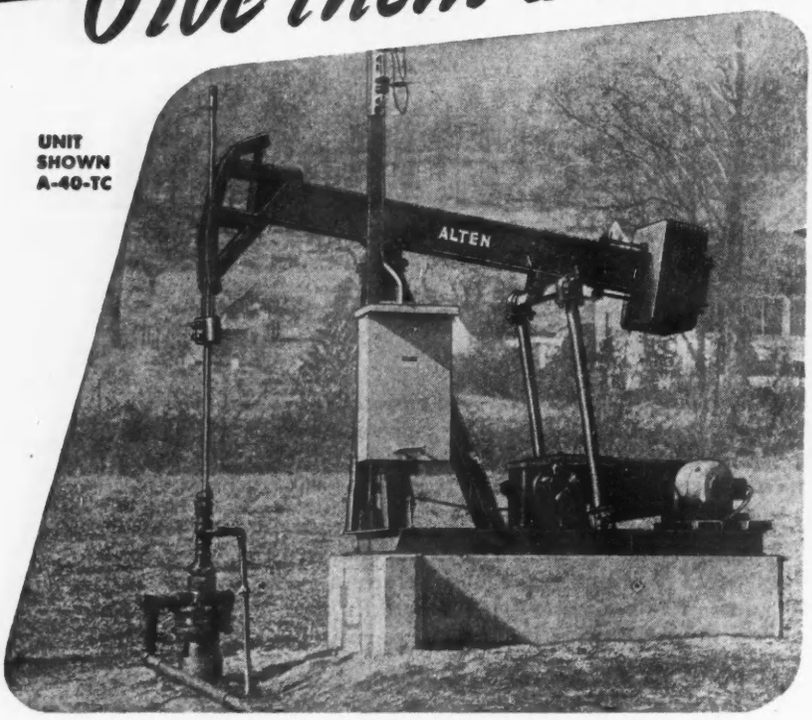
The purpose of this device is to eliminate the sympathetic vibrations and exhaust beat which are produced by unsynchronized engines. Further, when massive rotating unbalances are present, their effect is minimized by holding the unbalances out of phase so that they tend to neutralize each other.



The rotative speed and the phase position of the engine being controlled is picked up by a flexible shaft or selsyn motor and carried to the synchronizer. The air output from the controller is in turn piped back to the air motor attached directly to the fuel control of the engine. Air pressure from any convenient source is reduced to 20 pounds per square inch and used to operate the air serve system. The various components are assembled in a compact box which may be conveniently located anywhere in an engine room or power station.

For additional information write Synchro-Master, Seneca Falls 1, N. Y., *referring to* World Oil *item* 12.

ALTEN PUMPING UNITS *Give them a trial!*



UNIT SHOWN A-40-TC

Quality Features Include:

★ **High Capacity Double-Reduction Gear Reducer Chrome-Nickel Steel Pinions. Hardened Steel Gears. Helical Shaved Gearing. Roller Bearing Equipped Throughout.**

★ **Double-Row, Spherical Self-Aligning Wrist Pin and Equalizer Roller Bearings.**

★ **Rigid, All-Welded, Structural Steel Samson Post and Frame**

★ **Adjustable Stroke Lengths, Effective Balancing, For Use With Gas Engine or Electric Motor.**

★ **High Efficiency. Weatherproof Construction.**

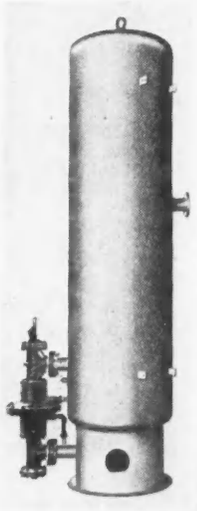
SEND FOR *New* CATALOG

Complete Pumping Unit Specifications. Also illustrates Alten Casing Heads, Stuffing Boxes, Stop Cocks and hundreds of other production items.

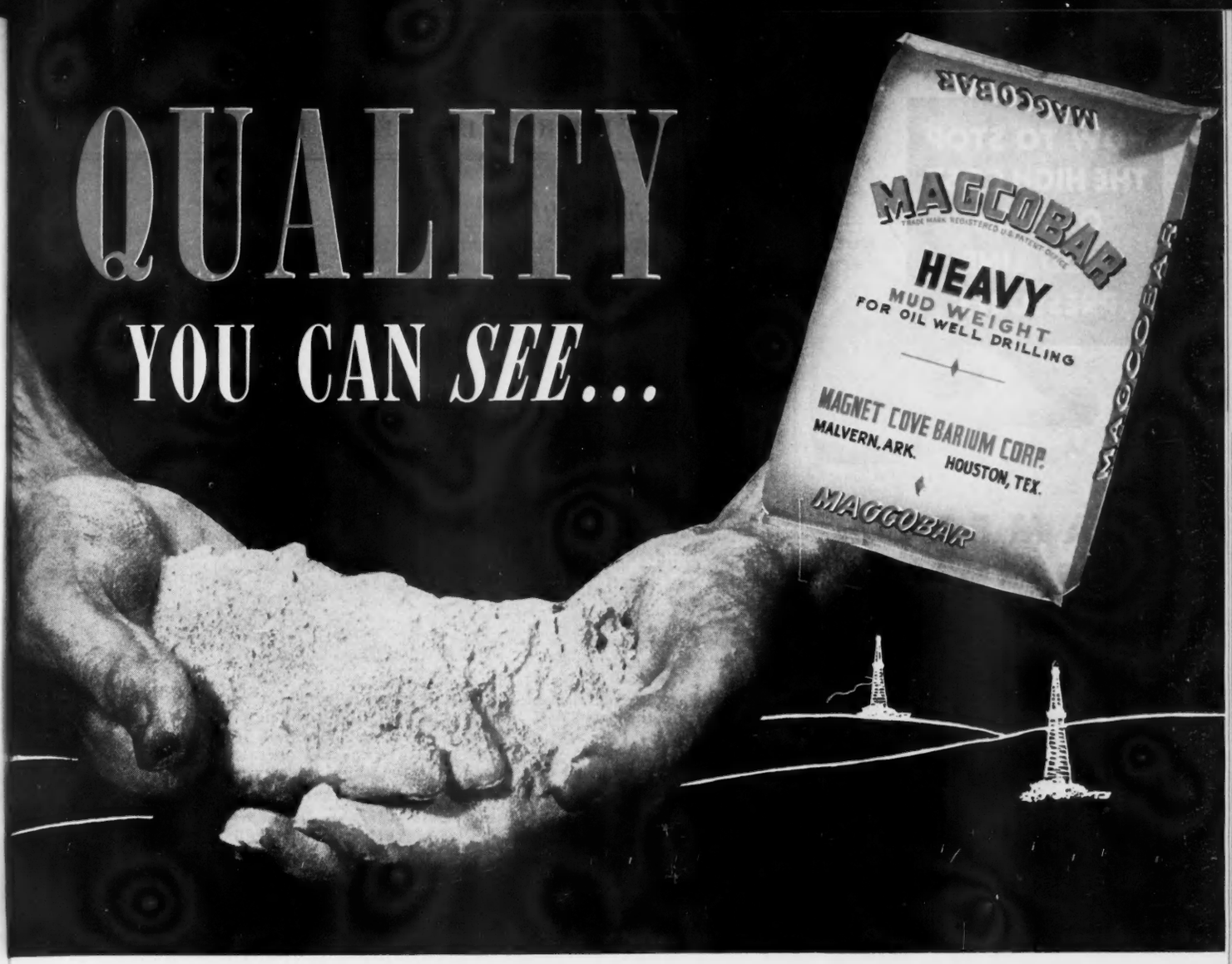
ALTENS
FOUNDRY AND MACHINE WORKS, INC.
LANCASTER, OHIO
Established 1889
Sold Through Dealers Everywhere

13—Dual Control Separator

Meeting the challenge of wells that flow by heads, wells being swabbed, or steady flowing wells is the Murdock Dual Control Oil and Gas Separator. The entire valve assembly is mounted on the outside of the separator for easy accessibility in inspection and servicing. All separators are equipped with dual control. Piping and valve fittings are furnished and installed at the factory. The separating element of Murdock separators are cast iron, and so designed to control, wipe, and separate moisture from gas. Pressure in the separator is kept balanced by the fluid change from the outer compartment to the inner compartment of the separator, therefore, there is no pressure drop through the separating element.



For additional information write Murdock Tank & Mfg. Company, Tulsa, *referring to* World Oil *item* 13.



GIVES RESULTS YOU CAN *CHECK!*

Just dip your hands into a bag of this high-purity mud weight material and you'll find two definite reasons why MAGCOBAR produces heavy drilling muds of low viscosity which are easier and less costly to control.

First, the uniformly whitish grey color of MAGCOBAR is visual evidence of its freedom from impurities normally associated with native Barite. Another reason is the particle size which is controlled carefully with special grinding equipment, hydraulic classification, thickening and flotation.

In the field, you can check this extra quality for results. MAGCOBAR has an unusually high specific gravity of 4.30.

Because of this purity, the initial viscosity of MAGCOBAR weighted mud is substantially lower and can be maintained with far less chemicals than mud weighted with other materials.

Look for the MAGCOBAR dealer sign when you need mud. There are more than 200 from the Rockies to Florida.

MAGNET COVE BARIUM CORP.
MALVERN, ARK. HOUSTON, TEXAS

Export: Guy E. Daniels, 30 Rockefeller Plaza, New York City, N. Y.

Magcobar
Complete
DRILLING MUD SERVICE
DEALER

Look for this sign WHEN YOU NEED MUD

MAGCOBAR • MAGCOGEL • HIGH YIELD DRILLING MUD • XACT CLAY • FIBER-SEAL • MAGCO-MICA • TANNATHIN • JEL-OIL MUD • JEL-OIL "E" • SALT GEL NOHEEV • SEAL FLAKES • MY-LO-JEL • CHEMICALS

HOW TO STOP THE HIGH COST OF HIGH MUD LINE PRESSURES

CAMERON
SHEAR-RELIEF
VALVE

With Cameron Shear-Relief Valves on your rigs, high mud line pressures will cost you only the price of one common nail.

Cameron Shear-Relief Valves protect pumps, manifolds, drilling hose, etc., against excessive pressures by releasing the flow of fluid through the valve outlet. A common nail shears when pump pressure against the valve piston reaches the shear stress of the nail.

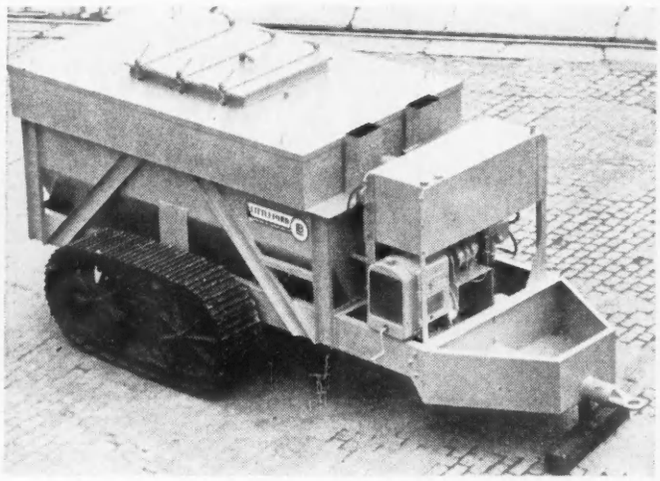
The sheared nail is the only damaged part, and the valve is easily reset with another nail by any member of the crew, using directions on the valve nameplate for nail sizes and the pressure at which each size shears.

Write for complete details or see your Composite Catalog.

Cameron
IRON WORKS, INC.
P. O. BOX 1212, HOUSTON, TEXAS
Export: 74 Trinity Place, New York, N. Y.

OTHER NEW EQUIPMENT

14—Pipe Line Kettles



A feature of Littleford Bros.' pipe line kettle is a single burner, which lights instantly with no preheating and burns from two quarts to 15 gallons of No. 1, 2, or 3 domestic fuel oil in an hour. This burner produces more units of heat than two burners on similar kettles.

Combined with a double heat circulation system, which distributes the heat over the entire sides and bottom of the kettle, there are no hot spots and no vent holes to cause flashing. All gases are forced to travel 20 feet before exhausting out the stack, so heat is not lost in heating.

Another feature is the hydraulic system for agitation. There are no electrical gadgets or motors needed to agitate the material. The hydraulic method of agitation takes all the sludge from the bottom of the melting pot and keeps the mineral filler in suspension. The hydraulic system will not break up when the kettle is being loaded or if material is not liquid enough, because overhead relief valves prevent the agitator from breaking while material is getting soft enough to allow agitation. This system is fully automatic and requires the operator's attention only for stopping or starting in motion.

The kettle is completely insulated to prevent any loss of heat. Splash plates help prevent spilling and splashing material when in transit.

For additional information, write M. J. Crose Manufacturing Company, Inc., Tulsa, Oklahoma, *referring to* WORLD OIL *item* 14.

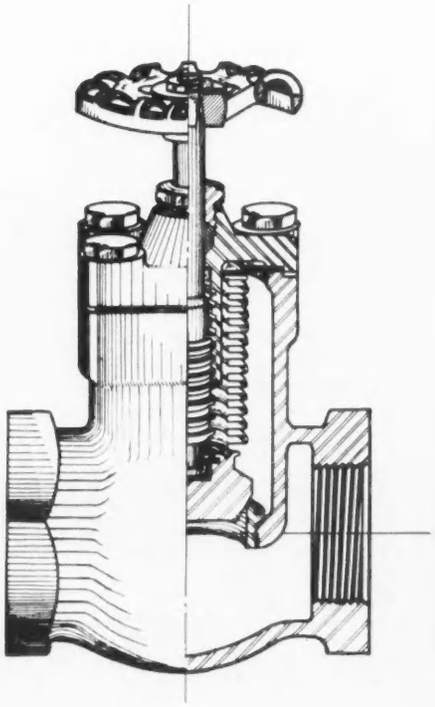
15—Packless Valve

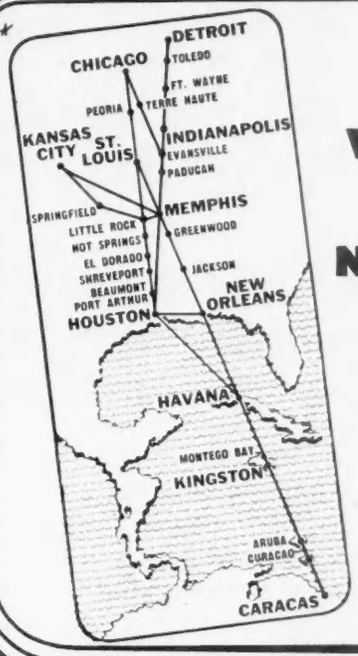
A packless valve which surpasses the service limitations of conventional valves in pressure, as well as temperature, eliminates the costly maintenance required with stuffing boxes and other means of preventing leakage.

This valves owes its leakproof performance and freedom from maintenance to the seamless metal bellows which forms a leakless connection between the valve disc and the valve body. This construction enables repeated opening and closing of the valve and no maintenance is required to keep the stem absolutely tight against leakage, even under extreme conditions of pressure or vacuum.

The valves are available equipped with stainless steel bellows and stainless steel bodies which adapt them for economical service in applications which would be impractical or impossible with conventional valves due to corrosive and other metal-wearing actions which are responsible for extremely high maintenance costs. The bodies of the new valves are also available in bronze, cast iron, cast steel or monel metal, thus adapting them to almost any valving need.

For additional information, write Dept. P-V, Fulton Sylphon Division, Robertshaw - Fulton Controls Company, Knoxville, Tenn., *referring to* WORLD OIL *item* 15.





NOW

A Direct Route to

VENEZUELA-JAMAICA-CUBA

from

NEW ORLEANS and HOUSTON

The C & S "CARIBBEAN COMET" provides direct, one-carrier service to Venezuela and South America from the oil and industrial area of the Southwest. One-plane service to Caracas and Kingston. Non-stop service from Houston to Havana. Three flights weekly from both Houston and New Orleans by fast, four-motored Dixieliners. Departures every Tuesday, Thursday, and Saturday afternoon.

"12 YEARS OF PERFECT SAFETY"

Ask your travel agent, or

CHICAGO & SOUTHERN AIR LINES

General Office, Memphis, Tennessee, U.S.A.

C★S

Why . . .

another expiration notice?

Many subscribers write us that even though they have renewed their subscription, they continue to receive expiration notices. Here's the reason:

Some renewal notices must be addressed two or sometimes three weeks before they are delivered. If a renewal reaches us during that time, it is impossible to remove that name from the unrenewed file.

If this is true in your case, please do not write unless your WORLD OIL fails to arrive.

WORLD OIL

(Established 1916 as The Oil Weekly)

P. O. Box 2608 Houston 1, Texas

ANNOUNCING

A Complete Factory Stock in

HOUSTON, TEXAS

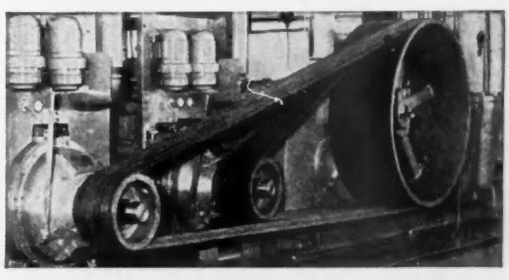
of

WORTHINGTON "QD" SHEAVES

AND

WORTHINGTON-GOODYEAR V-BELTS

For Oil Field and Industrial Use



Additional Stocks Available Through Our Distributors

A. M. LOCKETT & COMPANY, LTD.

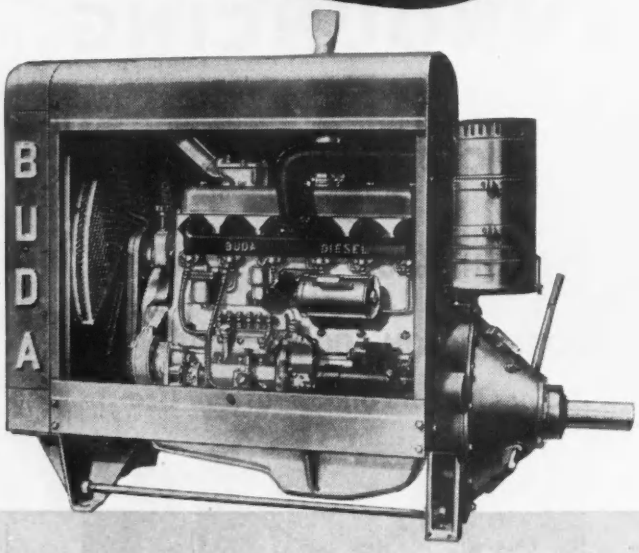
NEW ORLEANS HOUSTON DALLAS

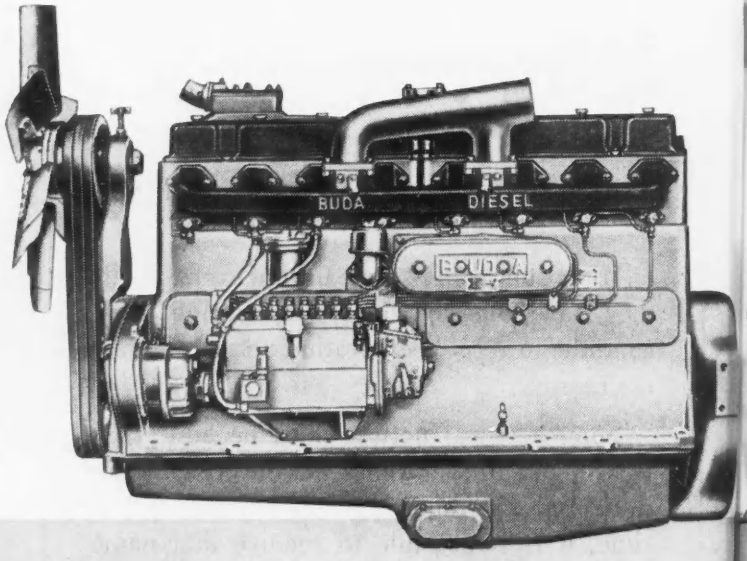
For real power economy around BUDA'S

190 Basic models to choose from —Many with interchangeable parts and mountings

The right size and type of engine for every oil field need—from 5 to 440 h. p.

Buda's complete line of 190 basic engine models affords a real opportunity to reduce power costs through the economies of standardization. Remember, Buda offers the widest available selection of engine sizes and types . . . with companion models for any fuel . . . plus interchangeable parts, mountings and accessories that save thousands of dollars annually in maintenance, overhead and servicing costs.





35 *Oil Field engines*

For powering drilling rigs, pumps, hoists, and all other types of oil field and industrial equipment, Buda builds 19 Diesel and 16 gas-gasoline engines and power units ranging from 5 to 440 h.p.

19 *Automotive engines*

For heavy-duty trucks, buses and big off-highway hauling units you have a choice of 9 Buda gasoline models and 10 Buda Diesels, ranging from 40 to 300 h.p. in the big super-charged units.

CLIP... MAIL TODAY

THE BUDA COMPANY, Harvey, Ill. (Chicago Suburb)

Send complete facts on Buda ☐ Power Units ☐ Automotive Engines ☐ Generator Sets ☐ Marine Engines

I am especially interested in ..... for .....

NAME ..... TITLE ..... COMPANY .....

ADDRESS ..... CITY ..... STATE .....

y standardize your needs
S COMPLETE LINE...

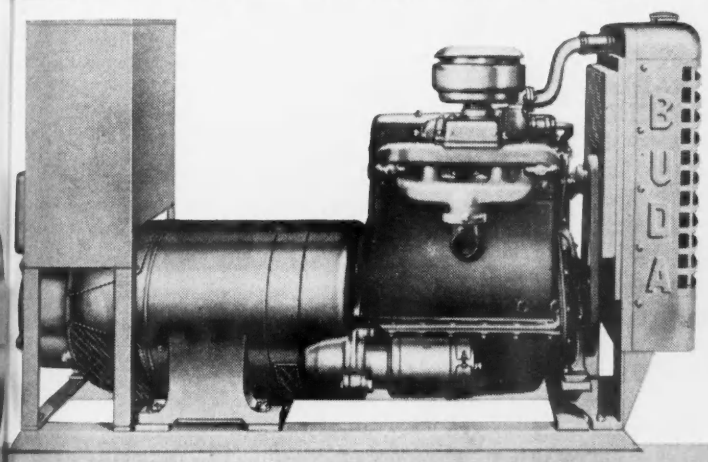
Performance-proved by thousands of satisfied users—plus 133 equipment manufacturers

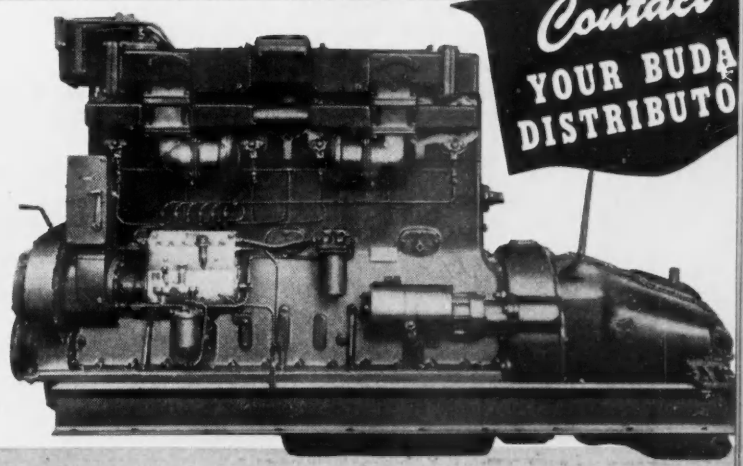
Today thousands of Buda Diesel and gas-gasoline engines are rendering efficient service on all types of oil field applications . . . bringing a steady flow of repeat orders from major oil companies, independent operators and leading drilling contractors the world over. In addition, dependable Buda power is now offered in practically every type of powered equipment built by 133 American and foreign manufacturers—proof of Buda economy.

World-Wide service and parts through experienced Buda Oil Field Engine Distributors

Wherever oil is being produced, you'll find an experienced Buda distributor nearby, ready to help you with your engine problems. Fully equipped with factory-trained engine specialists . . . adequate stocks of genuine Buda parts . . . modern shop and field repair facilities . . . your Buda distributor has everything it takes to serve your engine needs promptly, dependably and at low cost. Call him today.

Specify Buda on new equipment . . . buy Buda for replacements . . .





118 *Electric generator sets*

For light plants, refrigeration units and all types of auxiliary or stand-by electric power, there are 82 different models of Buda Diesel generator sets, plus 36 gasoline models, ranging from 2.5 to 125 KW.

18 *Marine engines*

As one of the nation's leading producers of marine engines for work boats, tugs, and other commercial and pleasure craft, Buda offers a complete line of 15 Diesel, 3 gasoline marine models, from 5 to 300 h.p.

BC-3-OF

BUDA

. . . a *Power-full* name in ENGINES

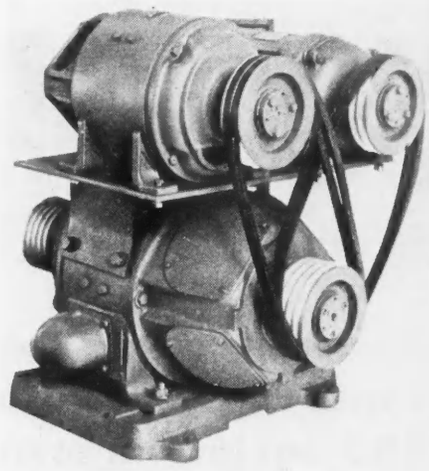
16—Automatic Bit Weight Control

The new G-E automatic bit-weight control consists of four components—a drag generator, an amplidyne-controlled regulating generator and exciter, a main control panel, and an operator's control panel. It can be applied to any kind of rotary drilling operation, electrical, mechanical, or steam.

The system automatically holds a pre-selected bit weight, independently of drilling speed, thereby assuring uniformity of weight on the bit. A "drag generator" applies the electrical hold-back torque to the drawworks drum, and an amplidyne-controlled regulating generator keeps this torque constant over the selected range of drilling speeds.

This control device is expected to speed up drilling operations by minimizing the number of times the entire drill stem must be brought to the surface to replace wornout drilling bits.

Simple to install, the bit-weight control system requires no additional power source; the same engine that drives the rig, belt-drives the regulating generator. The connecting power cables are equipped with coupler plugs and sockets.



For additional information, write General Electric Company, Materials Industries Div., Schenectady 5, N.Y., *referring to* WORLD OIL *item* 16.

Install Them and Forget Them!
AMERICAN
RADIAL
Roller Bearings
AMERICAN RADIAL ROLLER BEARINGS are engineered to exacting standards that result in better performance and minimum maintenance.
Furnished in 5 styles, 6 S.A.E. series and 85 sizes. Special designs also available. Write.
AMERICAN
ROLLER BEARINGS
AMERICAN
ROLLER BEARING CO.
420 Melwood Street Pittsburgh, Pa.
Pacific Coast Office:
1718 S. Flower St., Los Angeles, Calif.

17—Weed Killer

Triox, a non-selective weed killer made of sodium arsenite (arsenic trioxide), kills weeds and poisons the soil to prevent weed regrowth for about one to two years. It is relied on by many agricultural, industrial and civic organizations to reduce the fire hazard from weeds and lower fire protection costs. Arsenical weed killers have been used around lease tanks, wells, warehouses, and along fence lines, fire breaks, and rights-of-way. It is also used to clear off weeds and prevent regrowth on roads.

Triox can be applied any time of the year, although best results are obtained at the start of the rainy season when weeds are starting. Spot treatments can be made seasonally or annually to prolong weed control indefinitely.

For further information write California Spray-Chemical Corporation, Richmond, Calif., *referring to* WORLD OIL *item* 17.

18—Cold Rubber Tires

Passenger-car tires with treads made of the new type "cold rubber" are now on regular production. The tires bear no special markings, and will be released through regular sales channels. Production in which the new man-made rubber is used is limited as yet due to the small amount of low-temperature rubber available.

Cold rubber, recently announced by the government, gives improved wear. It is made at lower temperatures than those used in the manufacture of standard man-made rubbers and requires the installation of refrigeration equipment.

For additional information write The B. F. Goodrich Company, 448 S. Main St., Akron, Ohio, *referring to* WORLD OIL *item* 18.

TRUCO STANDARD
OIL FIELD BIT

TRUCO DIAMOND DRILL BITS mean *Irresistible Cutting Power*

Since the advent of diamond coring in the oil fields Truco engineers have made many improvements in design and matrix to increase footage in different formations and to permit increased circulation rates to maintain good mud and hole conditions.

Truco Bits penetrate the hardest known formations and 100% core recovery is usual—a standard of performance which is beyond improvement. Truco diamond drilling products include diamond washover shoes, reamers and all necessary adjuncts to every drilling condition and emergency.

WHEEL TRUEING TOOL COMPANY
3200 W. Davison Avenue
Detroit 6 • Michigan

WHEEL TRUEING TOOL CO. of CANADA, LTD.
575 Langlois Avenue
Windsor, Ont. • Canada

Truco Oil Field Products are distributed by
DRILLING & SERVICE, INC., DALLAS, TEXAS

19—Remote Control

A 16-page bulletin, 800-B, describes the varied manual and automatic remote control applications of Grove Flexflo expansible tube valves. Included are technical data and diagrams of typical arrangements suitable for stop valve, emerging shutoff and release valve, liquid level control, automatic flow controllers of the liquid type and gas type, shockless pump control and slow opening and closing check valve.

For additional information write Grove Regulator Company, 65th and Hollis Streets, Oakland 8, Calif., *referring to* WORLD OIL *item* 19.

20—Identification Chart

A roller chain identification wall chart for use by drilling rig operators has full-size scale drawing of Baldwin-Rex standard and heavy series single strand and multiple width roller chains. By holding a link or section of roller chain against the chart, or by measurements, its exact size can be readily determined and ordering made considerably easier.

For a copy of this chart, write Chain Belt Company, 1600 West Bruce Street, Milwaukee 4, Wis., *referring to* WORLD OIL *item* 20.

21—Variable Speed A. C. Drive

A four-page bulletin describes an alternating current motor having infinitely adjustable speed. The Louis Allis Company's Ajusto-Spede provides a variable speed output with a constant torque characteristic through an entirely new eddy current principle without the usual motor generator set or exciter.

For a copy of this bulletin, write Louis Allis Company, 427 E. Stewart Street, Milwaukee 7, Wis., *referring to* WORLD OIL *item* 21.

22—Dual-Fuel Attachment

A four-page pamphlet announcing the dual-fuel attachment for the "Caterpillar" D13000 Diesel engine underscores the versatility of the engine when the attachment is added and points up the economic operation of the entire unit when utilizing natural gas. Speed of installation and ease of operation of the attachment are emphasized in the publication.

For a copy of this pamphlet, write The Caterpillar Tractor Company, Peoria, Ill., *referring to* WORLD OIL *item* 22.

23—Oil Treating

"According to Hoil" is the title of a new folder describing Hoil Emulsion treating systems. Engineering data, installation photographs, and price quotations are included.

For a copy of this folder, write Hoil Engineering Corporation, 409 Philtower Building, Tulsa, *referring to* WORLD OIL *item* 23.

24—V-Belt Drives

How to select a standard drive using stock sizes of sheaves and V-belts is described in a 16-page catalog containing examples and belt and sheave selection charts for various speed ratios and horsepower ratings. A price list of sheaves and V-belts is included with general information on these items.

For a copy of this catalog, write Transmission Machinery Corporation, Dallas, *referring to* WORLD OIL *item* 24.

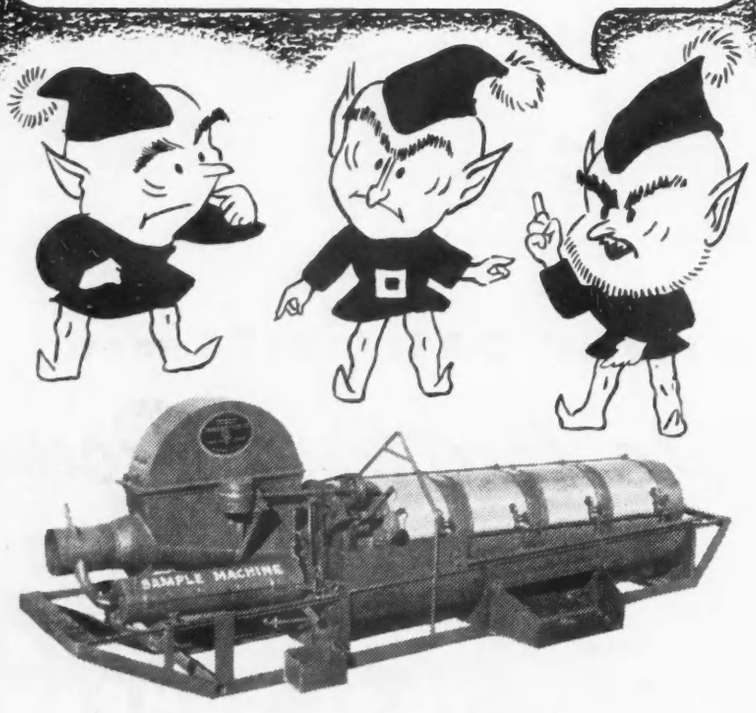
25—Hot High Temperature Valves

Kerotest stainless and alloy steel valves are described in a new four-page booklet, No. 47-AS. The booklet also includes a specification guide for valve buyers.

For a copy of this booklet, write Kerotest Manufacturing Company, 2525 Liberty Avenue, Pittsburgh, Penn., *referring to* WORLD OIL *item* 25.

"KILLER" SHALE SAYS:

AND STAY AWAY FROM ANY WELL WITH A THOMPSON SHALE SEPARATOR! YOU WON'T HAVE A CHANCE!



Shale and abrasives don't have a chance to chew up expensive drilling equipment when drilling mud is conditioned with a Thompson Shale Separator... *only clean mud* goes back into the well. If you are drilling deep, you'll want the Thompson "DWF," capable of handling maximum flow from the biggest mud pumps now in operation. Two other models available for shallow and medium depth wells. Attached SAMPLE MACHINE provides accurate foot-by-foot samples of cuttings. By-pass standard equipment on all models.

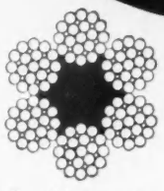
For complete data and specifications on all Thompson models, write today for free illustrated folder.

THOMPSON TOOL CO.
IOWA PARK, TEXAS

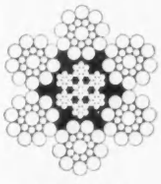
KEEPS DRILLING MUD CLEAN — PROVIDES *TRUE SAMPLES* OF CUTTINGS

-Preformed-
"HERCULES"
REG. U.S. PAT. OFF.
RED-STRAND
WIRE ROPE

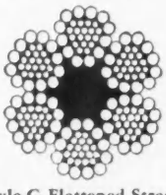
Easy to Handle . . . Safe and Economical to Use



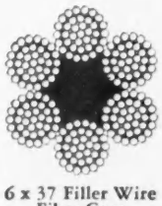
6 x 19 Filler Wire Fiber Core



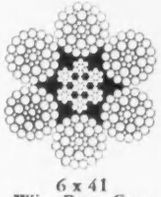
6 x 19 Seale Wire Rope Core



Style G-Flattened Strand Fiber Core



6 x 37 Filler Wire Fiber Core



6 x 41 Wire Rope Core

"HERCULES" (Red-Strand) Wire Rope has proved its worth by the accurate yardstick of actual performance. For over 60 years the Red-Strand has been a dependable guide to safe and economical wire rope service. Now in the Preformed type, a plus value has been added. As internal stresses are largely eliminated, the rope is less apt to kink . . . it is easier to handle . . . it spools better. But these are not the only advantages. Because internal stresses have been reduced there is less internal wear and more resistance to bending fatigue, which means longer life.

Another and an ever important factor in determining wire rope life is the use of the right construction for the work the rope is to do. To meet this situation, Preformed "HERCULES" (Red-Strand) Wire Rope is made in a wide range of both Round Strand and Flattened Strand constructions. There is a correct type for any heavy duty job. Our Engineering Department will be glad to help you make the right selection.

We invite your inquiries.

"HERCULES"*
RED-STRAND
the DEPENDABLE
WIRE ROPE
for any TOUGH JOB
* REG. U.S. PAT. OFF.

MADE ONLY BY

A. LESCHEN & SONS ROPE CO.

ESTABLISHED 1857

5909 KENNERLY AVENUE • ST. LOUIS 12, MISSOURI

NEW YORK 6 • CHICAGO 7 • HOUSTON 3 • DENVER 2
LOS ANGELES 21 • SAN FRANCISCO 7 • PORTLAND 9 • SEATTLE 4

• Walter Neustadt of Ardmore, Okla., in commenting on the article "Compensationitis — The Phony Injury Racket" (WORLD OIL for November), wondered if the racketeers could be curbed by finger-printing. His suggestion was referred to Charles F. Holmans, special agent in charge, Dallas office of the Claims Bureau, a division of the Association of Casualty and Surety Companies. Holmans' reply:

Thanks a lot for your letter of November 9 enclosing the letter from Walter Neustadt of Ardmore, Okla., commenting on the compensation insurance racket appearing in the last issue of your magazine. As a former special agent of the FBI, I will agree that his suggestion regarding finger-printing of all claimants submitting personal injury claims would be an excellent idea, but I have my serious doubts about its practical application. If such a requirement of finger-printing of the claimants were inaugurated by the insurance companies and their assureds, I surmise that before long individual claimants, organized labor, and damage suit lawyers handling these types of cases would raise a very vociferous objection in that we were trying to treat a claimant as a criminal by virtue of having filed a claim and exercising his rights under the law.

Another stumbling block would be that while we might secure cooperation from a few companies in securing finger-prints from their claimants, yet on the other hand, I have good reason to believe that the majority of them would not want to cooperate to such an extent, which would result in confusion and that some cases would be reported with finger-prints and others without, and probably some not at all because of this requirement. It would necessitate a complete changeover of our personnel in that we would have to employ trained finger-print clerks, in lieu of the file clerks presently being used, and for many, many other reasons that are too nmerous to mention, I just do not believe this proposition would work out. Frankly, we have enough difficulty trying to get the employer to give his claimant's Social Security number, his age, and even to tell us whether or not he is black or white. If the employers are lax in this regard, I feel pretty sure that they would not want to set up the idea of finger-printing their claimants.

Nevertheless, I must state that Mr. Neustadt's idea is well taken and shows that he is thinking in the right direction. We do like to receive comments from our assureds, as it shows they are interested in our problems.

Concrete River Weights

Sir:

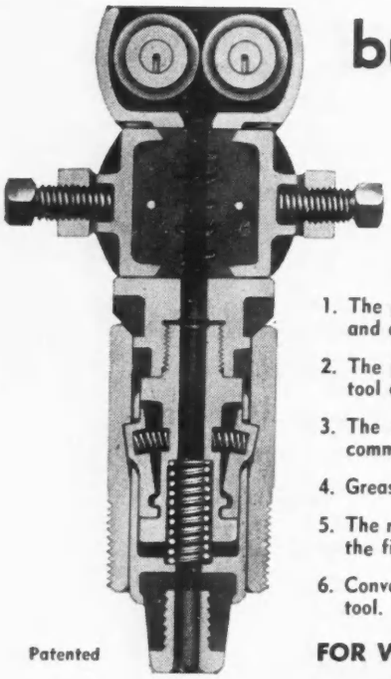
On page 229 of your November number you have an article on concrete river weights which states "concrete weights require approximately 1.55 times the volume of cast iron."

Engineering tables show concrete weight in the 135-150 pound range per cubic foot, cast iron at 450 pounds. This would give a ratio of 3:1 instead of the 1½ stated. I believe that the author of the paper erred in not stating clearly that the concrete river weights are spaced at half the distance usually specified with cast iron weights, which would require the weight ratio stated. In one installation where cast iron weights were specified for installation on each weld of 40-foot pipe, the concrete weights were spaced at 20-foot intervals, being laid in the trench and the pipe strung through them before the upper halves were put in place and bolted down.

I believe that, if you will run this letter in your magazine, it will clear up any misunderstanding which the wording of the original article on concrete weights may have caused.

W. PEARCE,
Jefferson, Texas.

Low Maintenance
no Undue Pressure



Patented

but *Be Sure*

Be Safe

With A 3AR Wire Line STRIPPER FOR SWABBING TUBING

Type 3AR King Wire Line Stripper ("Oil Saver") is the ideal tool to use in connection with swabbing operations.

1. The positive latch and sure release insure against accidents and eliminate the possibility of jerking a wire line in two.
2. The packing is inserted from the sides of the tool and the tool can be repacked while the line is in the hole.
3. The roller line guides center the line; outlasts the more commonly used bushing many times.
4. Grease nipples are provided to lubricate the guide rollers.
5. The non-sparking materials used in its construction minimize the fire hazard.
6. Convenient hand holds contribute to easy handling of the tool.

FOR WIRE LINE CORING THE 4AR KING WIRE LINE STRIPPER IS WIDELY USED.

The Type 4AR Stripper is similar to the Type 3AR, except it is a little larger. It is commonly used in connection with the Type 4C King Circulating Head. It can be, and sometimes is, used with other makes of circulating heads.

These tools are constantly coming into greater use. A trial is convincing.

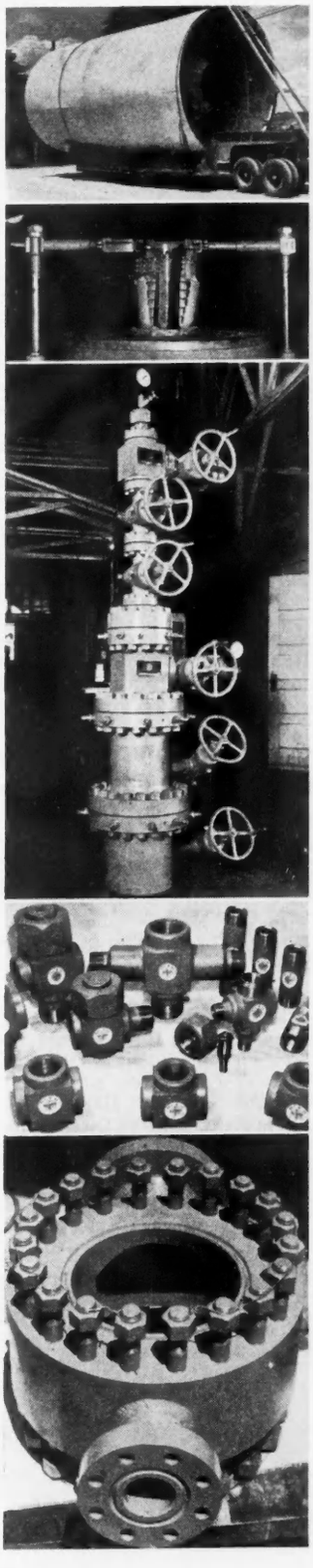
All prices F. O. B. Houston, Texas, and subject to change without notice.

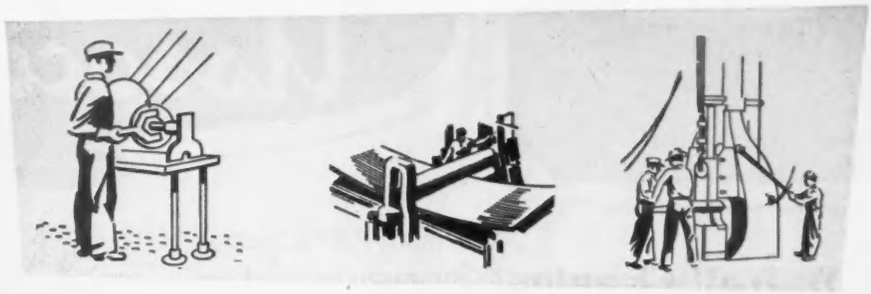
Sold through your supply store

***Export:* R. S. STOKVIS & SONS, Inc.**
17 Battery Place, New York 4, N. Y.

See 1948 Composite Catalog for detailed description of other King Tools.

KING OIL TOOLS
210 TERMINAL STREET PHONE W. 6-8013
HOUSTON 10, TEXAS





DeCo's been solving problems for a long time..

WHICH MEANS——

that the DeLaney Company "know-how" assures you the best in quality fabrication of tanks, multi-cones, ladders, walk ways, skids, etc., forgings of carbon and alloy steel to specification and production of DeCo Balanced Power Slips, Forged Steel Well Head Equipment, Forged Fittings and space-saving Elliptical Opening Mud Crosses and Adapters.

To give you prompt, efficient service, problems are thoroughly thought out . . . then solution, well planned and executed.

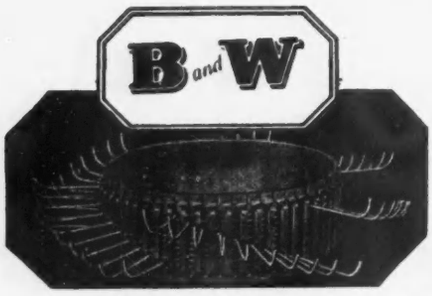
. . . for the best in field performance choose DeCo Equipment..

DeCo oil field equipment sold through leading supply stores.

THE DELANEY CO.

Steel Fabricating-DeCoForged Steel Well Head Equipment-DeCo Power Slips-Forgings

6119 East Montgomery Road, Houston 9, Texas.



(Patented and Patents Pending)

B & W Wall Cleaning Guides are your best insurance for a good cement job the first time

DON'T SQUEEZE!

It Can Be Avoided

BRUCE BARKIS — B-W INCORPORATED — KENNETH WRIGHT

Well Completion Specialists

HOUSTON, TEXAS • LONG BEACH, CALIF.

NOW 3 FINE

Jimmie Gray COMPOUNDS

INSURE **LONGER LIFE FOR TOOL JOINT THREADS**

EXCLUSIVE 500 TON SPECIAL

You can always break the joint when you use Jimmie Gray Compounds! Each one is engineered to do certain specified jobs best!

KANT-GALL TOOL JOINT COMPOUND

Both new compounds have the same dependable quality, the same money-back guarantee as the widely used Jimmie Gray 500 TON Special!

LONG-LIFE DRILL COLLAR COMPOUND

SOLD BY SUPPLY STORES EVERYWHERE

STANDARD OIL SALES CO.

BOX 203 HOUSTON, TEXAS
CHARTER 4-5648

Associations

Annual AIME Session Set for San Francisco February 13-17

The 1949 annual meeting of AIME will be held in San Francisco February 13-17. It is timed to coincide with the Centennial celebration of the California gold rush. Entertainment will be in traditional San Francisco style, with a social program of more than usual interest.

Technical sessions and luncheons will be held for all divisions of the institute, with papers promised by many men who are leaders in their specialties. Proposed field trips include Kettleman Hills and the Rio Vista Gas field, Grass Valley and the Yuba gold fields, the Permanente cement plant, and a post-convention tour to Hawaii. An attendance of several thousand is expected.

Headquarters will be at the Fairmont Hotel. AIME members who have not yet made arrangements should write for hotel reservations to AIME Housing Bureau, Room 200, 61 Grove Street, San Francisco 2. Give a first and second choice of hotels, and enclose a deposit of $5 per person or $10 per room. Some informal get-togethers are scheduled for Sunday, February 13, and registration starts Monday morning.

Mid-Continent Pipe Line Group Elects T. A. Hester

T. A. Hester of the Oklahoma Contracting Company, Inc., Dallas, was elected president of the Mid-Continent Pipe Line Chapter at the annual meeting in Tulsa, November 16-17. Twenty-seven members and 31 associate members heard James D. Marshall of Washington, D. C., talk on problems affecting the pipe line contracting industry.

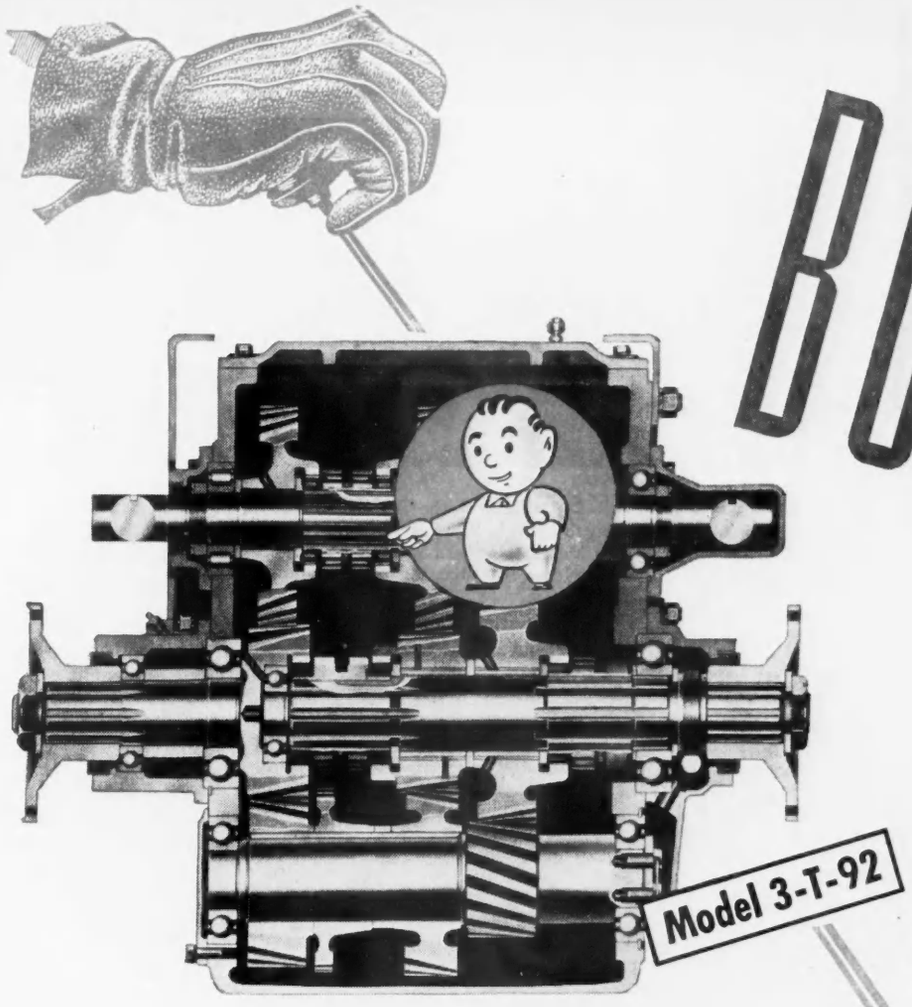
Other officers and directors elected were J. R. Horrigan, Horrigan Construction Company, Inc., Houston, vice president; Ray L. Smith, Ray L. Smith & Son, Inc., El Dorado, Kansas, vice president; James P. Neill, H. C. Price Company, Bartlesville, Okla., treasurer; F. E. Stanley, Midwestern Constructors, Inc., Tulsa; C. S. Foreman, C. S. Foreman Company, Kansas City, Mo.; J. C. Britton, Britton Contracting Company, Inc., Fort Worth; Robert D. Sheehan, Sheehan Pipe Line Construction, Company, Tulsa; N. A. Saigh, N. A. Saigh Company, Inc., San Antonio; E. G. Morrison, Morrison Construction Company, Austin; Robert Thomas, O. C. Whitaker Company, Fort Worth; and Richard A. Gump, reelected executive secretary.

Kansas-Oklahoma Division of Mid-Continent Group Elects

William T. Payne, president, Big Chief Drilling Company of Oklahoma City, was reelected president of the Kansas-Oklahoma Division, Mid-Continent Oil and Gas Association, at the annual meeting in Tulsa.

The board reelected the following officers: L. G. Owen, Tulsa, first vice president; H. E. Zoller, Derby Oil Company, Wichita, Kansas, vice president for Western Kansas; Carl Weiner, Chanute, Kansas, vice president for eastern Kansas; A. W. Ambrose, president, Cities Service Oil Company, Bartlesville, Okla., vice president for northern Oklahoma; Lloyd Noble, Ardmore, Okla., vice president for southern Oklahoma; W. R. Wallace, Oklahoma City, vice president for western Oklahoma; Clarel B. Mapes, Tulsa, secretary-treasurer.

TULSA GEOPHYSICISTS ELECT—With the election of new officers, the Geophysical Society of Tulsa began another full program which will include monthly sessions presenting distinguished geophysicists from all over the world. Preparing the year's schedule are the new officers. Left to right, Dr. A. B. Bryan, The Carter Oil Company, president; Francis F. Campbell, Amerada Petroleum Corporation, first vice president; G. D. Lambert, Shell Oil Company, secretary-treasurer, and V. L. Jones, University of Tulsa, second vice president.



BUILT IN

. . . not Built On

A full-torque power take-off is built into the case of Model 3-T-92 Fuller Auxiliary Transmission. By making the power take-off an integral part of this three-speed auxiliary, Fuller has eliminated the loosening and separation of parts that sometimes occur in a combination of auxiliary and top-mounted power take-off. The result is a trouble-free unit for heavy-duty trucks engaged in logging, rigging and other operations which may require power for truck-mounted winches, generators or pumps. Model 3-T-92 maintains the Fuller Manufacturing Company's reputation for transmissions that are easy-shifting, quiet-running and long-wearing.

FULLER MANUFACTURING COMPANY, TRANSMISSION DIVISION
KALAMAZOO 13F, MICHIGAN

Model 3-T-92 is also distributed through the dealer organization of
TULSA WINCH DIVISION OF VICKERS, INC.

Fuller TRANSMISSIONS

WHY BUY LESS

...the best costs so little

CM HOISTS AND PULLERS are ruggedly constructed to give you years of trouble-free service. Yet they are unusually light... easy to handle because they are constructed of the strongest alloys of steel and aluminum. Equipped with famous Herc-Alloy flexible, welded alloy steel chain.

- Capacities from ¼ to 10 ton.
- 1-ton model weighs only 35 pounds.
- 96% efficient—easy to operate.
- Lifetime lubricated.

NEW CM CYCLONE

- Capacities ¾, 1½, 3 and 6 ton.
- ¾-ton model weighs only 13 lbs.
- Lifts or pulls at any angle.
- Lifetime lubricated.

NEW CM PULLER

Write for catalog and name of your nearest CM dealer.

CHISHOLM-MOORE HOIST CORPORATION

(Affiliated with Columbus McKinnon Chain Corp.)

GENERAL OFFICES AND FACTORIES: TONAWANDA, N. Y.

SALES OFFICES: New York • Chicago • Cleveland San Francisco • Los Angeles

PEPA ELECTS McNEESE—Officers of the Petroleum Electric Power Association elected at the 20th annual meeting. Left to right, L. V. Dugas, Gulf States Utilities Company, Beaumont, Texas, secretary-treasurer; John B. Moore, Northern Indiana Public Service Company, Hammond, Ind., vice president; and C. L. McNeese, Houston Lighting and Power Company, Houston, president.

Electrical Equipment Now Available, PEPA Informed

Petroleum electric power executives and engineers from the Southwest, in a three-day session of the Petroleum Electric Power Association at the Biltmore Hotel, Oklahoma City, December 1-3, were told that the use of electric power in the oil and gas industry continues to increase and that electrical equipment, with the possible exception of aluminum wire, is now readily available. It was pointed out that a recent survey showed that 31 percent of all the nation's pumping oil wells are being served with electric power, which continues to be one of the cheapest commodities in the country. PEPA leaders also declared that although operating expenses in the electrical industry have increased, companies furnishing power are able to keep costs down because they are selling approximately 95 percent of their power capacity, and through general refinancing of higher interest-carrying bonds are now operating on cheaper money.

It was the association's 20th annual session and approximately 100 members registered for the meeting at which symposiums on the essentials of selling power to the production, pipe line and refinery branches of the industry were featured.

G. A. Davis, president, Oklahoma Gas and Electric Company, Oklahoma City, delivered the opening address and warned that the power industry must continue to fight encroachments of federal agencies in that field while the industry must also work in harmony with all government projects which will benefit the nation. A. R. Watson, president of the association, presided at the opening session, which was featured by a luncheon given by the Ted Workman Advertising Company of Dallas.

Papers delivered during the sessions included: "Advertising Plan and Budget for 1949," Ted Workman, Ted Workman Advertising Company; "Petroleum Power and the Universe," Dr. Irving Perrine, Oklahoma City; "A Few Suggestions for Power Association Betterment," D. C. McKee, president, Empire District Electric Company, Joplin, Mo.; "Essentials of Selling Power to Oil Producers," R. E. Patrick, Kansas City Gas and Electric Company, Wichita, Kansas; "Electric Equipment for Production," J. H. Poore, General Electric Company, Dallas; "Essentials of Selling Power to Pipeliners," T. E. Graham, Oklahoma Gas and Electric Company, Oklahoma City; "Electric Equipment for Pipe Lines," M. A. Hyde, Westinghouse Electric Corporation, East Pittsburgh, Penn., and F. G. Giger, Allis-Chalmers, Norwood, Ohio; and "Essentials of Selling Refinery Power," C. L. McNeese, Houston Lighting and Power Company, Houston. Discussion leaders included: Ned W. Beaudreau, Central Power and Light Company, Corpus Christi, Texas; J. W. Lambert, Southwestern Public Service Company, Borger, Texas; R. A. Swindell, Westinghouse Electric Corporation, Dallas; Jas. E. Moody, Southwestern Gas and Electric Company, Shreveport; B. F. Thompson, Public Service Company of Oklahoma, Tulsa; T. V. Grayson, West Texas Utilities Company, Abilene, Texas; V. G. Murdock, Allis-Chalmers, Norwood, Ohio; J. W. Struwe, Southwestern Gas and Electric Company, Shreveport.

Association President A. R. Watson, vice president, Southwestern Public Service Company, Amarillo, Texas, and Charles T. Evans, vice president, Arkansas Power and Electric Company, Little Rock, spoke at the annual banquet on "My Year as President" and "One More Chance."

Geophysicists Announce Candidates for Offices

The Society of Exploration Geophysicists has announced nomination of candidates for executive officers for 1949. Candidates for president are Andrew Gilmour of Tulsa, and M. M. Slotnick of Houston. Vice presidential candidates are Roy L. Lay of Houston and George E. Wagoner of Shreveport. Nominees for secretary-treasurer are Kenneth E. Burg of Dallas and Curtis H. Johnson of Los Angeles. Candidates for editor of *Geophysics*, the society's journal, are Richard A. Geyer of Houston and Sigmund Hammer of Pittsburgh.

Results of the mail ballot will be announced at the society's annual meeting at St. Louis in March.

PERFORATE...
TEST...
ACIDIZE...
and TEST again...

JOHNSTON DOES IT

all in ONE trip...

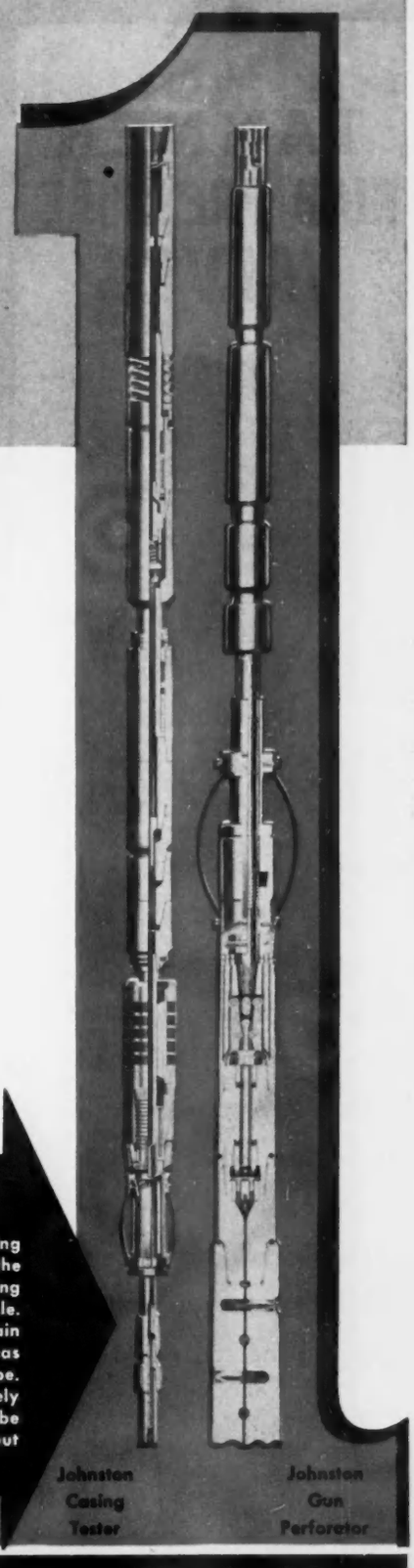
You don't spend a lot of time and money yo-yoing drill pipe when you use Johnston's SHOOT-N-TEST service because you can perforate . . . and test . . . and acidize, if required . . . and test again without ever coming out of the hole.

This combination . . . the Johnston Hydrostatically Actuated Gun Perforator and Johnston Casing Tester . . . cuts many hours off completion time . . . saves wear and tear on equipment . . . gets your wells on production faster.

For complete information about this faster, safer, know-what-you're-doing completion method, contact your nearest Johnston representative.

ACIDIZING THROUGH THE JOHNSTON TESTING TOOL

If results obtained on a Johnston Casing Test indicate a necessity for acidizing, the job can be done effectively without pulling the pipe and Testing Tool from the hole. After acidizing, the formation can again be tested and the procedures repeated as often as required without once pulling pipe. Where necessary to break down extremely tight formations, high pressures can be applied through the Testing Tool without damage.



JOHNSTON OIL FIELD SERVICE CORPORATION
5702 Navigation Blvd., Houston, Texas
"SERVICING MID-CONTINENT AND GULF COAST AREAS"
Abilene, Alice, Cisco, Graham, Throckmorton, Tyler, Victoria, Wichita Falls, Texas; Lake Charles Louisiana; Magnolia, Arkansas; Laurel, Natchez, Mississippi; Chickasha, Oklahoma; New Harmony, Indiana; Fairfield, Illinois.

M. O. JOHNSTON OIL FIELD SERVICE CORPORATION
3035 Andrita Street, Los Angeles 41, California
"SERVICING CALIFORNIA—PERMIAN BASIN—ROCKY MOUNTAIN AREAS"
Bakersfield, Avenal, Sacramento, Ventura, Santa Maria, Calif.; Odessa, San Angelo, Texas; Casper, Wyo.; Hobbs, N. M.

M. O. JOHNSTON OIL FIELD SERVICE COMPANY
"EXCLUSIVE EXPORT SALES"
3035 Andrita Street, Los Angeles 41, California

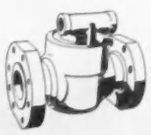
FORMATION AND CASING TESTING
JOHNSTON

TANNER
HIGH PRESSURE
VALVES

LAST LONGER

Because of the extreme ease of operation and the entire elimination of lubrication and plug adjustment, the possibility of allowing the valve to remain in a position other than fully opened or fully closed is greatly reduced — thereby reducing the possibility of cutting the seats and plug.

These valves are used in DRILLING, CEMENTING and PRODUCING. Available in either flanged or screwed ends. Valve sizes range from 1" to 4". Write for our catalog for complete details.



C. L. TANNER CO.
6887 Farmdale Avenue
North Hollywood, California

CARLSON HEADS COMPACT—Left to right: Gov. Frank Carlson of Kansas, newly-elected chairman of the Interstate Oil Compact Commission; Gov. Beauford H. Jester of Texas, retiring compact chairman; N. E. Tanner, Minister of Lands and Mines, Province of Alberta, Canada; and Hiram M. Dow, Santa Fe, N. M., a former chairman of the compact.

Gulf Coast Region Discussed At Houston AAPG Session

Stratigraphy, sedimentation and tectonics of the salt dome region of the Gulf Coast was the theme of the regional meeting of the AAPG at the Rice Hotel, Houston, December 2-3. More than 1000 geologists from Texas, Louisiana and Mississippi attended the four sessions to hear 13 technical papers.

Paul Weaver, chief geophysicist of Gulf Oil Corporation, and 1948 president of the AAPG, opened the sessions with a discussion of "Modern Views as to Salt Dome Mechanics."

Other papers presented: "Types of Gulf Coast Salt Domes," by Oscar Wilhelm; "Recent Sediments of the Mississippi Deltaic Mass," by Harold N. Fisk; "Stratigraphy of the Frio Formation in Orange and Jefferson Counties, Texas," by Milton F. Reedy, Jr.; "Sedimentary Facies of the Upper Cenozoic and Recent in the Gulf Coast Geosyncline," by Sheperd Lowman; "Problems of Deep Drilling in the Gulf Coast Area," by Olin G. Bell; "Salt Dome Configuration," by Marcus A. Hanna; "Tertiary History of the Gulf Coast Geosyncline," by Martin M. Sheets; "Possible Effects of Salt Intrusions on Sedimentation at Boling Dome," by William M. Cogen; "Photogeology in Gulf Coast Exploration," by Charles DeBlieux; "Exploration in the Gulf of Mexico with the Air-Borne Magnetometer," by Robert Ray; "Oil in the Gulf of Mexico," by D. A. McGee and A. T. F. Seale; and "Recent Developments in Geophysical Exploration Equipment," by C. H. Carlisle.

The Houston Geological Society served as host to the meeting which was concluded with a banquet and dance.

Geological Societies Unite To Form National Institute

Eleven national societies representing the geological sciences, with a combined membership of more than 10,000 professional geologists, have completed arrangements for the organization of an American Geological Institute. Aim of the organization is to direct the talents of the geologic profession into more effective channels of national service, under the sponsorship of the National Research Council.

Directors of the institute, named by the affiliated societies, held their first meeting at Washington, D. C., in November.

President of the new Institute is Dr. A. I. Levorsen, dean of the School of Mineral Sciences, Stanford University. W. B. Heroy, consulting geologist and geophysicist of Dallas, is vice president, and Dr. Earl Ingerson of the U. S. Geological Survey, Washington, D. C., is secretary-treasurer.

Headquarters of the Institute will be established at the National Academy of Sciences, Washington, D. C.

Humble Engineer Is Winner Of AIME Alfred Noble Prize

Robert L. Hoss, petroleum reservoir engineer for Humble Oil & Refining Company, Houston, will be awarded the Alfred Noble Prize at the February meeting of AIME in San Francisco. The award will be made by the various Founder Societies and the Western Society of Engineers for his paper, "Calculated Effect of Pressure Maintenance on Oil Recovery," published in *Petroleum Technology*, September, 1947.

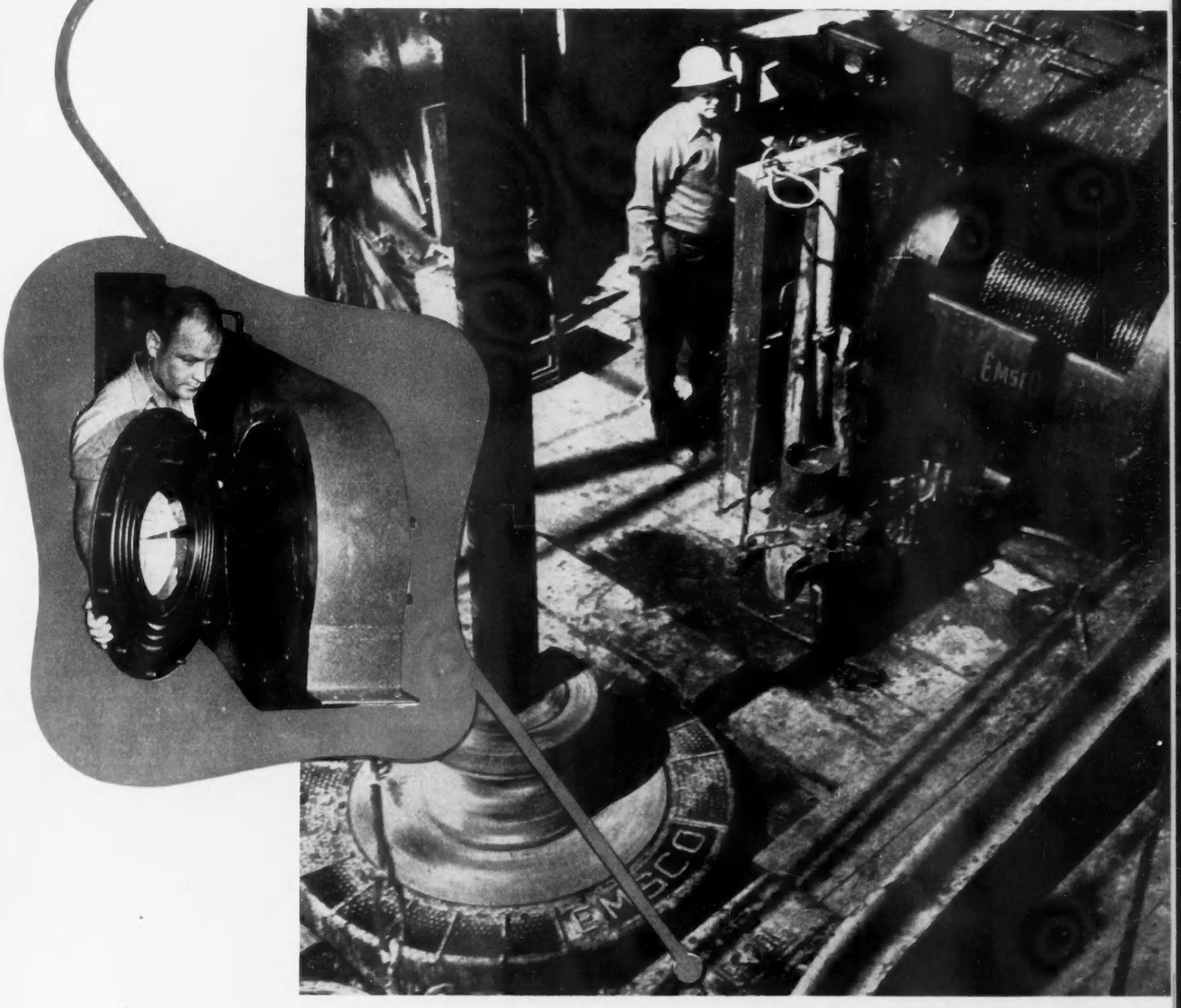
Robert L. Hoss

After receiving his B. S. degree from the University of Tulsa in 1942, he joined the Phillips Petroleum Company. From 1943 to 1946 he served in the U. S. Army Air Force in North Africa and the Middle East. He joined the Kewanee Oil Company in 1947, after obtaining his Masters degree from the University of Texas, and in June of that year he became associated with Humble. He is a member of the AIME, the API and the AAPG.

EMSCO

with the oil industry's first oil bath rotary drive

USES MURRAY RUBBER FOR THE STOPPER



Since rotary chain life depends largely on the lubrication it receives, drawworks and chain manufacturers alike have worked long and hard on this problem. EMSCO . . . the first and only drawworks manufacturer to date with an oil-bath rotary drive . . . solved the problem with the help of Murray Rubber. A molded rubber "stopper" (see illustration) provides a seal around the chain sprocket and drive shaft. Bellows in the rubber seal allow it to take rig vibration without wear or strain.

With the facilities of the largest, most modern and complete mechanical rubber manufacturing plant in the South and a staff of skilled engineers, Murray can help you develop new, or improve your present, rubber components for your oil field equipment.

Murray Rubber

MURRAY RUBBER CO.

HOUSTON, TEXAS

Dr. Frederick G. Keyes Wins ASME Medal on Honors Night

Dr. Frederick G. Keyes, head of the department of chemistry, Massachusetts Institute of Technology, Cambridge, Mass., was awarded the ASME Medal during the Honors Night dinner of the society at New York.

Edward Smith Cole, president of Pitometer Log Corporation, New York, was awarded the Worcester Reed Warner Medal. The Holley Medal, for scientific and engineering achievement, was bestowed on Edwin H. Land, president of the Polaroid Corporation, Cambridge, Mass.

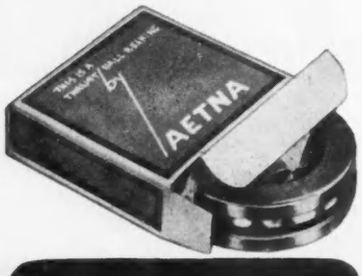
Dr. Theodore von Karman, scientist in the field of applied mathematics, received the John Fritz Medal.

Honorary memberships in the ASME were conferred on five men who have achieved distinction in the fields of engineering, industry, invention and education. They went to Dr. Lyman J. Briggs, director emeritus of the Bureau of Standards, Washington, D. C.; James W. Parker, president of the Detroit Edison Company; Oscar A. Leutwiler, professor emeritus, University of Illinois; Carl F. Braun, president of C. F. Braun and Company, Alhambra, Calif.; and George I. Rockwood, chairman of the board of trustees of Worcester Polytechnic Institute, Worcester, Mass.

Link McKISSICK MPC SAFETY to Aetna and it adds up to SAFETY Smoothness COMPLETE SATISFACTION...

IN TUBING OR TRAVELING BLOCKS

The dependable performance of Aetna thrust bearings in McKissick safety blocks is another example of their ability to stand up under the gruelling and exacting applications encountered in oil field equipment.



It makes economical sense to buy Aetna bearing equipped products . . . . to use Aetnas in the equipment you make. Their well known savings stem from exceptionally high standards of dimensional uniformity, hardening, grinding and assembly — all focused toward transforming a given amount of steel into an ultimate amount of bearing efficiency.

Aetna

AETNA BALL AND ROLLER BEARING COMPANY
4600 Schubert Ave. • Chicago 39, Illinois

BALL AND ROLLER BEARINGS

Write for 52 Page Engineering Catalog

THE OIL MAN'S CALENDAR

1949	
JAN.	
10–14	Society of Automotive Engineers, Annual Meeting, Book-Cadillac Hotel Detroit.
10–14	American Society of Mechanical Engineers, Materials Handling Joint with Management Division, (Includes Exhibit), Convention Hall, Philadelphia.
26–27	Northwest Petroleum Association, Hotel Nicollet, Minneapolis.
Mar.	
1– 2	Wisconsin Petroleum Association Annual Convention, Schroeder Hotel, Milwaukee.
7–10	Manufacturers Standardization Society of the Valve and Fittings Industry, Annual Meeting, Commodore Hotel, New York, N. Y.
9–11	American Petroleum Institute, Southwestern District Meeting, Galvez Hotel, Galveston, Texas.
23–25	American Petroleum Institute, Mid-Continent District Meeting, Mayo Hotel, Tulsa.
24–25	New England Gas Association, Hotel Statler, Boston.
APRIL	
4– 5	Industrial Accident Prevention Association Convention, Royal York Hotel, Toronto, Canada.
4– 6	American Gas Association, Distribution Motor Vehicle and Corrosion Conference, Netherlands-Plaza Hotel, Cincinnati.
11–13	National Association of Corrosion Engineers, Netherlands-Plaza Hotel, Cincinnati.
12–14	Southwestern Gas Measurement Short Course, College of Engineering, University of Oklahoma, Norman.
13–15	National Petroleum Association, Hotel Cleveland, Cleveland.
18–20	Midwest Power Conference (11th Annual Meeting), Hotel Sherman, Fort Worth.
20–22	National Gasoline Association of America, Annual Convention, Texas Hotel, Fort Worth.
20–22	Southern Gas Association, Convention Buena Vista Hotel, Biloxi.
27–29	American Petroleum Institute, Eastern District Meeting, William Penn Hotel, Pittsburgh.
MAY	
2– 4	Independent Petroleum Association of America, Mid-Year Directors Meeting, New Orleans.
9–10	American Gas Association, Natural-Gas Department, Spring Meeting French Lick Springs Hotel, French Lick, Ind.
9–11	Liquefied Petroleum Gas Association, Annual Convention and Trade Show, Palmer House, Chicago.
12–13	American Petroleum Institute, Division of Production, Pacific Coast District Meeting, Biltmore Hotel, Los Angeles.
12–13	Indiana Independent Petroleum Association, Spring Convention and Outing, French Lick Springs Hotel, French Lick, Ind.
26–27	American Petroleum Institute, Rocky Mountain District, Gladstone Hotel, Casper, Wyoming.
26–27	The Natural Gas and Petroleum Association of Canada, Annual Meeting, Hotel London, London, Ontario.

Nomads Chapter monthly meetings: **Los Angeles,** second Wednesday, Jonathan Club. B. M. Landis, Secretary. **Houston,** second Monday, Houston Club Harry E. Estes, Secretary. Telephone Charter 4-7611. **Dallas,** L. A. Little, Secretary. Telephone Justin 8-1726. **Tulsa,** third Wednesday, Hotel Tulsa, Anthony Gibbon, Secretary, Telephone 3-1844. **New York,** first Monday, Louis Sherry's, Norris Boulden, Secretary, Telephone WIckersham 2-1311, extension 260.

The

Igloo WATER COOLER

"the truly Convertible Cooler"

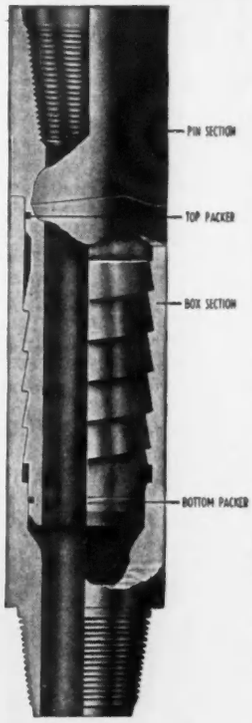
This cooler is corrugated for greater strength and durability being of all welded construction. It is fully insulated with granulated cork to keep water colder longer. Added features include, conversion from spigot to non-spigot type, no solder joints to break out and a reinforced innerbottom.

Igloo Water Coolers and Spigots Are Available at All Supply Stores

The IGLOO MANUFACTURING CO.

3809 McKinney Avenue — Houston 3, Texas

BOWEN SAFETY JOINT



For

DRILLING—FISHING
FORMATION TESTING
SETTING PACKERS

O. D. and I. D. same as regular tool joints

Will not release or back off any easier than regular tool joints.

Does not interfere with drilling, fishing or testing procedures.

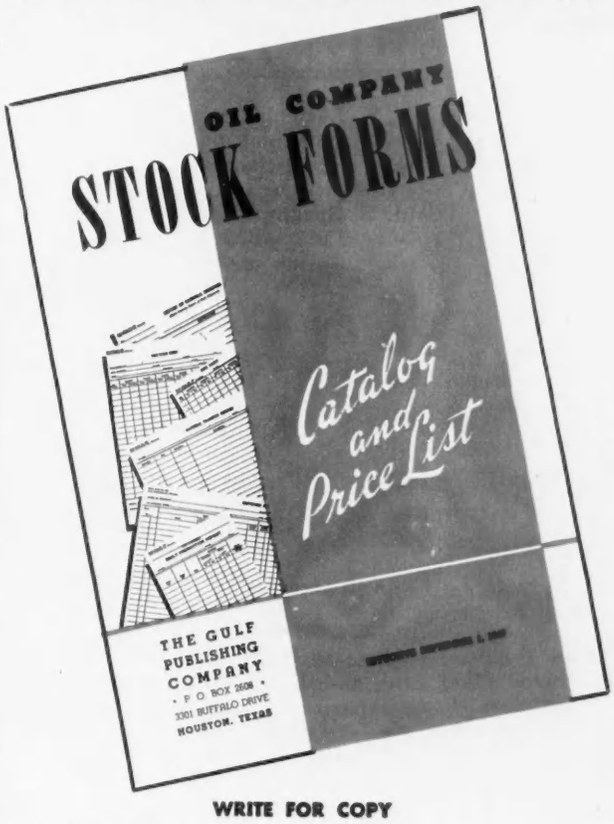
Requires no special tools or attention.

Will release only by deliberate procedure of the operator.

BOWEN CO. of TEXAS, INC.

Office: 2429 Crockett St., P. O. Box 1025, Phone A. 8-4568
HOUSTON 1, TEXAS
Odessa, Texas, Phone 789—Midland, Texas, Phone 1439
Oklahoma City, 6-8087—Houma, La., 6709

THIS CATALOG WILL SAVE YOU $$



WRITE FOR COPY

GULF PUBLISHING CO. • P. O. BOX 2608 • HOUSTON

KILL WEEDS NOW

...the easy chemical way with TRIOX®

Now is the time to use TRIOX . . . before weeds flourish after the fall rains. TRIOX will kill 'em before they get started so you'll have no dead weeds to clean off later. TRIOX is a potent chemical weed killer . . . and it's a cinch to apply. It will sterilize the soil against weed growth and prevent plant growth from 2 to 3 years. TRIOX treated weeds have fire retardant value! Use TRIOX around buildings, tanks, on driveways, walks, yards, parking areas—in fact, any place where weeds are a problem. TRIOX comes in 5, 30 and 50 gallon drums—better order some today and clean up those weeds. Phone the nearest office below for information and prices.

ORTHO
SCIENTIFIC PEST CONTROL

CALIFORNIA SPRAY-CHEMICAL CORP.

Richmond, Calif. (phone 3366) • Whittier, Calif. (phone 436-31) • Oklahoma City (phone 7-6468) • Kansas City, Mo. (phone Grand 5126)

HEAVY DUTY-RUGGED....

THE INDUSTRY'S LEADING CENTRIFUGE

*3480

You can maintain your required speed for the full period of the test with much less effort. Curtin centrifuges, proven world-wide, are heavy duty, rigidly constructed, and extremely simple in design. Illustrated bulletin, giving full details, available upon request.

W·H·CURTIN & CO.

HOUSTON .... NEW ORLEANS.

BARRET

SPECIALIZING IN MAGNETIC SURVEYS

Contracts accepted for domestic and foreign projects, using the most improved instrumental and interpretative technique.

William M. Barret, Inc.

Consulting Geophysicists

GIDDENS-LANE BUILDING
SHREVEPORT, LOUISIANA

HOUSTON LABORATORIES

Analytical and Consulting Chemists

Podbielniak Gas Analyses, Oil Field Brines, Waters, Cores, Muds, etc. Reservoir equilibria studies for crude and condensate wells.

LD 267—Box 132 Houston, Texas

TRADING POST AHEAD PAGE 278

Men in the Industry NEWS

O. H. Carlisle, division manager, and **H. S. Gwyn,** assistant division manager, Gulf Oil Corporation, will retire January 1. Carlisle got his first job at the Brenham Agency of the Waters Pierce Oil Company in 1897. Gwyn went to work for Waters Pierce on the docks at Galveston in August of the same year. The January, 1901, Spindletop discovery resulted in the removal of Gwyn from Galveston to Houston and in the transfer of Carlisle from Brenham to Beaumont. Gwyn became chief clerk in the Waters Pierce office in Houston and Carlisle was made assistant agent in Beaumont. In 1903 Carlisle joined the Southwestern Oil Company, where he remained until 1904, when he went to work for Gulf Refining Company. He served for a time as Gulf agent in Houston, occupying this position until 1905, when he was succeeded by Gwyn. He

O. H. Carlisle

H. S. Gwyn

was appointed division sales manager in 1931. In 1918 Gwyn took on most of the duties of assistant division manager.

During World War II, Carlisle served PAW and worked with OPA as a member of the Gasoline Advisory Committee. Gwyn also served on a PAW subcommittee, was a member of the Office of Defense Transportation, National Liquid Transport Committee and served as advisor on several ODT state committees.

»

A. C. Long, vice president of the California-Texas Oil Company, Ltd., has been appointed assistant to the chairman of the board of The Texas Company. Long has been associated with the company and its affiliates since 1930, except for a period during World War II when he served as petroleum attache for the State Department at London.

»

J. D. Anderson, division petroleum engineer of the Casper, Wyoming, Production division of The Ohio Oil Company, has been made manager of the Purchasing department. Anderson joined Ohio in 1936 and has served as division petroleum engineer since 1942. **E. W. Shoupe,** assistant purchasing agent, has been promoted to purchasing agent. **M. E. Loose,** head of the Production Budgeting department, will become assistant to the manager of the Purchasing department.

W. A. Maley was named manager of the Exploration department for Humble Oil & Refining Company. **J. Ben Carsey** was named chief geologist; **Ed J. Hamner,** California exploration manager, and **Douglas E. Bell** was promoted to head production geologist. **Hines H. Baker,** president, announced that these changes were made in view of the election of **L. T. Barrow** as chairman of the board and the consequent increase in the responsibilities of **Morgan J. Davis,** director in charge of exploration, and because of expansion in Humble's exploration activities. Maley first became associated with Humble in 1925. His work for Humble has been in Southwest Texas where he became district geologist for the Corpus Christi area in 1930 and division geologist in 1937, with headquarters at Corpus Christi. Carsey has been with Humble since 1925. He was West Texas division geologist from 1932 to 1941, when he was transferred to Louisiana as division geologist. In 1946 he was named assistant chief geologist. Hamner became associated with Humble permanently in 1932. He has held several different positions with the company and in 1946 he was named an assistant chief geologist. Bell was employed by Humble in 1934. His work has been principally on the Gulf Coast.

W. A. Maley

»

A. E. Lacomble, president of Shell Development Company, San Francisco, has been elected chairman of the board. Lacomble will be succeeded as president by **M. E. Spaght,** vice president. Lacomble

A. E. Lacomble

M. E. Spaght

joined Shell in 1920. After various executive assignments in the interest of Shell companies, he was elected chairman of the executive committee of Shell Development Company, and succeeded to its presidency in 1943. Spaght, who has been with Shell 15 years, was appointed vice president of Shell Development in May, 1946.

Men in the Industry NEWS

Norman J. McGaw, vice president of Shell Oil Company, has been elected to the board of directors and has been assigned new duties. He will move from San Francisco to New York to organize and direct a new department dealing with economic studies of the oil industry in general, as well as with Shell's own forward planning and major development projects. McGaw joined Shell as a clerk in San Francisco in 1925. He served in various capacities on the Pacific Coast and in 1933 was transferred to St. Louis, where he served first in the president's office and later as manager of transportation and supplies. He was made vice president in charge of transportation and supplies in 1939.

Norman J. McGaw

»

William W. Valentime has been elected to the Board of Directors of Union Oil Company of California. Valentime, who is president of the Fullerton Oil Company, will fill the vacancy caused by the death of the late **S. M. Haskins.**

Sylvain J. Pirson, head of the Department of Petroleum and Natural Gas Engineering at Pennsylvania State College, has resigned to join the Engineering department of Stanolind Oil & Gas Company in Tulsa as research reservoir engineer.

»

Frank E. McCorkle, former chief accountant at Standard-Vacuum Oil Company's Japan office, has left the company's service under the established retirement plan. McCorkle went to Japan as a junior accountant in 1919.

»

W. C. Patton, former driller and tool pusher in the Illinois Basin, has moved to Stillwater, Okla., where he has organized the W. C. Patton Drilling Company.

»

Mrs. R. G. Rapp has been elected president of the Denver Producing and Refining Company, Oklahoma City, succeeding her husband who was killed recently in an airplane accident.

»

J. Harold Perrine, administrative assistant, Research and Development department, Sun Oil Company, has been elected to the board of trustees of Grove City College, Grove City, Penn.

Nelson Jones has been appointed general attorney for Humble Oil & Refining Company, succeeding **R. E. Seagler.** Jones, a member of Humble's law department since 1937, has resigned as vice president and member of the board of directors of Humble Pipe Line Company to accept this position. Seagler will open a private law practice in Houston, with office space with the firm of Morris, Underwood, and Oldham. He joined the Law department of Humble in 1925, became head of the trial division in 1929, and was appointed general attorney in 1938.

Nelson Jones

»

J. S. Feroe has been elected president of Beacon Petroleum Company, Tulsa, replacing **E. Q. Beckwith,** who recently joined the Sid Richardson Gasoline Corporation of Fort Worth. **H. R. McFarland** has been reelected vice president and secretary and **R. E. Bolinger** vice president and treasurer.

THOMPSON-HAYWARD

FORMALDEHYDE

for corrosion control

You can protect your casings, rods, and all exposed metal parts for only a few cents a day. You can

- SAVE ON PULLING COSTS
- SAVE ON NEW STEEL
- SAVE ON SHUTDOWN TIME

Thompson-Hayward Formaldehyde gives dependable protection from hydrogen sulphide corrosion and corrosive mine and well waters.

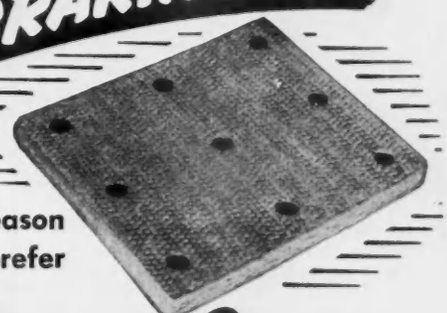
Write our nearest office for detailed information

THOMPSON-HAYWARD CHEMICAL CO.

Dallas, Wichita, Houston, Tulsa, New Orleans, Denver, San Antonio

(B)

SMOOTHNESS OF BRAKING...



. . . another reason why drillers prefer

Standco NO-SMOKE BRAKE LINING

There's no grabbing when Standco Lining is used. It has a nice feed-off and slight lever pressure controls the heaviest strings of pipe.

More deep wells have been drilled with Standco than with all other blocks combined.

Be sure Standco No-Smoke Brake Lining is on all your rigs.

STANDCO BRAKE LINING COMPANY

Factory and General Offices

2701-2801 Clinton Drive, Houston, Texas

SHORT CUT to LOW COST export CRATING

HECCO

You'll find HECCO's professional export crating service low cost and superior in every way. HECCO will take full responsibility for crating your products and getting them to the proper carrier for shipment.

Experienced personnel, modern equipment and proper plant location make this outstanding service possible.

W. 3-4619 W. 3-4610

HECCO

HOUSTON EXPORT CRATING AND CONSTRUCTION COMPANY, INC.

7400-14 Wingate Houston 11, Texas

MEN IN THE INDUSTRY NEWS

Gage Lund has been elected a vice president of Standard Oil Company of California.

Gage Lund

Lund, who was made a director of Standard in January, 1948, also is chairman of the board of The California Company and the Standard Oil Company of Texas, both wholly-owned subsidiaries of Standard of California operating in the Rocky Mountains, Texas and the Southeast, and of the Richmond Exploration Company, Standard's subsidiary operating in Venezuela.

»

Thomas J. Murphy, Jr., has been promoted to assistant district landman for The Texas Company at Midland, Texas, succeeding **J. W. Hunt,** resigned.

»

H. D. Amos and **George W. Hassell** of Oklahoma City and **James S. Smith** of Wichita Falls, Texas, independent oil operators, have organized the Standard Oil Development Corporation of Oklahoma City.

»

E. Owen Scott, Jr., has joined the geological staff of Warren Oil Corporation's Corpus Christi district office. After serving 5½ years with the Army Air Forces, Scott returned to the University of Texas, where he graduated in 1946.

»

T. R. Pierce has been advanced to superintendent of transportation for General Petroleum Corporation's installations at Taft, Calif.

»

George D. Larson has been made assistant party chief of a Stanolind Oil and Gas Company seismograph party operating in South Texas. Larson was a seismograph interpreter in the company's Houston office. **Lee A. McCrummen** who was a farm boss in Stanolind's Hastings district, Alvin, Texas, was made production foreman in the district.

»

John A. Walstrom and **J. H. French** have been appointed vice presidents of Asiatic Petroleum Corporation. Walstrom was formerly in charge of the petroleum section of the Federal Bureau of Supply, Treasury Department. He was ordered to active duty in the Navy in June, 1941. Later he became director of the Theater Division of the Army-Navy Petroleum Board and was released from active duty as a commander in March 1946, when he joined Asiatic Petroleum. Walstrom succeeded **B. P. Coppinger** as sales manager of Asiatic Petroleum on January 1, 1948. French joined the firm in November, 1939, and in June, 1945, was appointed treasurer, which office he still holds.

S. T. McCardell has been promoted to division superintendent-drilling and production, Louisiana Division, Producing department, The Texas Company. **J. A. Battle, Jr.,** assistant division petroleum engineer, has been advanced to division petroleum engineer, succeeding McCardell. McCardell started with the company 15 years ago and has been division petroleum engineer, New Orleans, since 1945. Battle started to work as a roustabout in 1925 and has served as assistant division petroleum engineer since 1945.

»

Churchill T. Shelton, for 21 years an oil production engineer in Indonesia with Standard-Vacuum Oil Company's producing subsidiary there, has retired. Shelton entered the oil business in 1920 with The Carter Oil Company. In 1927 he went to Palembang, Sumatra, with Standard-Vacuum Petroleum Maatschappij. He was assigned in 1942 to supervise the erection of ocean terminal gasoline importing facilities and airfield refueling stations for the Air Transport Command. Afterwards he participated in gas plant construction work in Caripito, Venezuela. He returned to Indonesia after V-J Day and served with Standard-Vacuum's war damage committee, making extensive surveys of company losses in Java and Sumatra.

»

Max W. Ball, director of the Oil and Gas Division, U. S. Department of Interior, whose resignation was effective December 1, has returned to private consulting practice at Washington, D. C. Previous to his appointment as director of the Oil and Gas Division in 1946, Ball had served as chairman of the oil board of the U. S. Geological Survey, engineer and law officer of the U. S. Bureau of Mines, manager of exploration in the Rocky Mountains region for Shell Oil Company, president of Argo Oil Company, and during the war was with PAW. His successor has not been appointed, but **Robert E. Friedman,** assistant director, has been made associate director.

»

Charles S. Coates, general superintendent of operations and construction for Tennessee Gas Transmission Company, has been made a vice president. Coates' first experience in oil and gas operations was as a roughneck for Richardson Petroleum Company, Corpus Christi. He later went with The Chicago Corporation where he became division superintendent, and in 1943 joined Tennessee Gas as assistant to the vice president. He was made general superintendent in 1947.

Charles S. Coates

W. H. Ferguson

E. F. Battson

E. F. Battson, New York vice president of Continental Oil Company, was named vice president and manager of operations in the Rocky Mountain area, effective February 1. He will succeed **W. H. Ferguson,** executive vice president, Denver, who will retire on that date after 35 years of service. **L. L. Aitken, Jr.,** executive assistant to Ferguson, will become assistant manager of operations in the Rocky Mountain area, with headquarters in Denver. Battson joined Continental in 1922, was promoted to assistant division manager at Butte, Mont., and became manager at Butte in 1929.

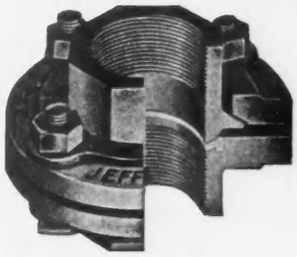
L. L. Aitken, Jr.

Leaving Butte in 1932, he was promoted to assistant general sales manager, Kansas City; Northern sales manager, Chicago; Eastern sales manager, New York, and was appointed assistant to the president in 1946. He was elected a vice president early in 1948. Aitken had been associated with Continental as an attorney in Denver for ten years prior to his promotion last July to executive assistant to Ferguson. Ferguson will continue as a member of the Continental board of directors. He joined Continental in 1922 and served as a director and general counsel until his election as vice president in 1929. He was elected executive vice president in 1929.

»

E. H. Walker, general manager of Shell Oil Company's personnel and industrial relations organization, has been appointed a vice president. His new title coincides with a substantial increase in the activities of the personnel and industrial relations organization. A graduate of Louisiana State University, Walker joined Shell in 1932 as a counterman in the storehouse at the firm's Norco, La., refinery. Following service in a wide range of positions in the Engineering department and in various operating departments at Norco, he was transferred to St. Louis in 1936 as personnel assistant in the Manufacturing department. In 1940 he was named manager of the Personnel department, with offices in New York, and three years later he became general manager of personnel and industrial relations.

Jefferson Malleable Unions



STYLE "B"

JEFFERSON Style "B" three-piece flange union is made with brass-to-iron and iron-to-iron seats. Being made of highly refined AIR FURNACE iron, it assures you of lightweight construction, perfect ball joint, and positive seating arrangement, whether or not in alignment.

★ ★ ★

HYDRAULIC PRESSURE RATING

Sizes	Test Pres.	O. W. G.	S.W.P.-550 Deg.
½" thru 4"	2000#	800#	250#
5" and 6"	1200#	500#	250#
8" and 10"	1000#	400#	250#

Malleable iron used in all JEFFERSON unions meets ASTM-4733, Grade 35018—M. T. 53000 Lbs., giving 75%-more elongation 50%-more impact value and is 30%-stronger than cupola malleable iron.

Obtainable through your jobber

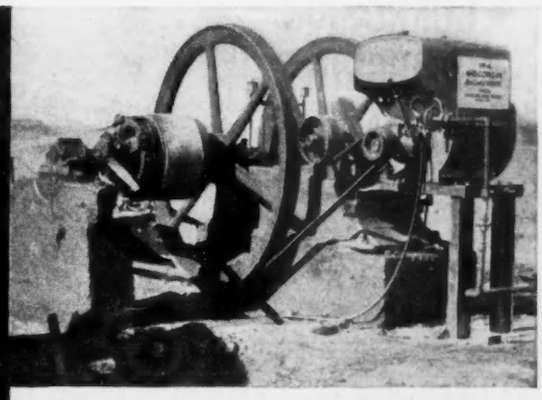
Jefferson Union Company, Inc.

691 West 26th St.,
New York 1, New York

71 Gooding St.,
Lockport, New York

31 Fletcher St.,
Lexington, Mass.

WISCONSIN *Air-Cooled* ENGINE *Weighing* 482 Lbs. *Replaces* 6000 Lb. Engine!



This new Wisconsin Heavy-Duty Air-Cooled VF-4, 4 cylinder Engine saves three ways . . . in weight, space, and cost! The power unit is 13 times lighter than the old power plant it replaces — occupies only a fraction of the space . . . and actually cost less than repairs required for the old unit.

Builder of this ingenious bandwheel power installation is Mr. James A. Quigg, owner of the Star Machine Works of Dewey, Oklahoma. A total of 12 oil wells are pumped by the unit.

Wisconsin Engines are supplied in 4-cycle single-, 2-, and 4-cylinder (V-type) models in a full range of sizes from 2 to 30 hp.

FOR DEPENDABLE ALL-WEATHER SERVICE — SPECIFY "WISCONSINS"

WISCONSIN MOTOR Corporation
MILWAUKEE 14, WISCONSIN
World's Largest Builders of Heavy-Duty Air-Cooled Engines

WRITE TO HARLEY SALES CO.
510 Atlas Building, Tulsa, Oklahoma
M & M Building, Houston, Texas
Oil field distributors for Wisconsin Engines and all types of utility units.

James P. Owen has been named district office manager for Sun Oil Company in Hamtramck, Mich. **Edward M. Winslow** has been appointed to a similar position in Hartford, Conn. Owens joined Sun Oil in Florida and spent considerable time in the company's Southeastern region. He was appointed district office manager at Hartford in October, 1944. Winslow, who succeeds Owens at Hartford, joined Sun Oil in the Detroit office. Prior to his new appointment he was office manager at Baltimore, Md.

D. C. Baker has been promoted to division superintendent, drilling and production, Rocky Mountain Division, Producing department, The Texas Company. Baker, who has been district superintendent, Rocky Mountain Division at Casper, Wyo., succeeds **J. F. Blackwell,** who was advanced to assistant division manager, Denver.

»

C. W. Faris has resigned as petroleum engineer with Shell Oil Company at Midland, Texas, to join **J. E. Warren** in the newly established consulting engineering firm of Faris and Warren at Midland.

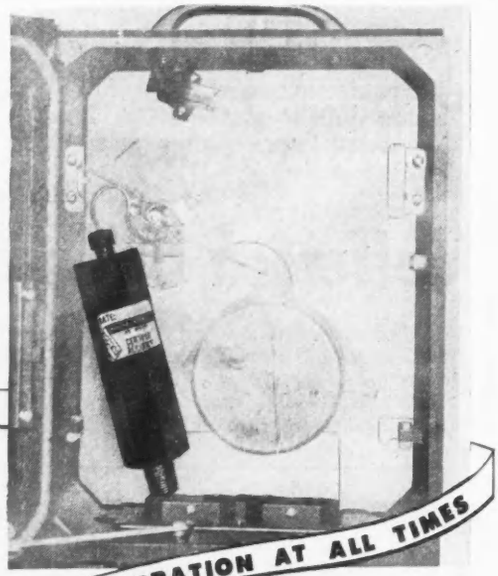
IT'S NEW!

Tried and Proven*

I I C 'S "O" RING SEAL

Protects Your Pressure Elements From:

• CORROSION
• CLOGGING
• PULSATION



ASSURES CERTIFIED CALIBRATION AT ALL TIMES

CUTS COST OF INSTRUMENT REPAIRS 80%
INCREASES LIFE OF INSTRUMENT 5 TO 1

The I. I. C. "O" Ring Seal affords complete protection for all types of pressure gauges. All interior works are monel. It is silicon-filled, not subject to freezing; is compact, new, and effective. "O" Ring Seals will be installed on new instruments free of charge at our plant or service branch. The "O" Ring Seal can be mounted INSIDE most recorders. Type H will operate under working pressures from 0-500 up to 0-20,000 P. S. I. Type L, on pressures from 100" H_2O up to 300 P. S. I.

I. I. C. Supplying

Barton Rupture-Proof Differential Meters . . . Aeroquip, High and Low Pressure Hose cut to lengths . . . E. L. I. Sub-Surface Pressure Gauges and Clocks . . . Ingersoll-Rand Compressors and Pumps . Ashcroft and Crosby Pressure Gauges . . . Bristol-Foxboro and Brown Pressure Recording Gauges . and many other precision instruments for Oil Field use.

I.I.C. Manufacturing

"O" Ring Seals . Orifice Plates . . . Meter Manifolds of all types . Orifice Well Testers . . . Deadweight Testers . . . Specialty Instruments for the Oil Industry.

Mfd. By

Industrial Instrument Co. of Odessa

Box 1909, Odessa, Texas

Certified Instrument Repair Service on All Types Instruments and Clocks.

*One large acidizing company has eliminated expensive replacements and repair by installing I. I. C.'s "O" Ring Seals in their Recorders. Name furnished on request.

J. W. Pittman has been promoted to general superintendent of the New Orleans area production staff for Shell Oil Company, Inc. Before his transfer he served as manager of Shell's production division at Lake Charles, where he had direct supervision of all production operations in Louisiana. Pittman has been associated with Shell for 14 years. During World War II he served in the infantry as lieutenant-colonel and was awarded the Bronze Star with two oak leaf clusters. Also added to the area staff were **G. Stewart,** area reservoir engineer, and **J. W. Watson,** sub-surface engineer. New division offices have been established at Franklin and Donaldson. The Franklin division, with **W. C. Gorden** as manager, will have supervision over South Louisiana. Gorden was formerly district superintendent at Houma. The Donaldson division, headed by **H. F. Winham,** will cover southeast Louisiana with the exception of the Delta territory, which will be under the supervision of the New Orleans area office. The Lake Charles division under **W. E. Owen,** who succeeds Pittman as manager, will have supervision over the remaining territory in west and north Louisiana.

J. W. Pittman

»

Jack M. Clover has resigned as landman and general field superintendent for Wilcox Oil Company, Tulsa, and will become an independent operator. He was with Wilcox for 23 years.

»

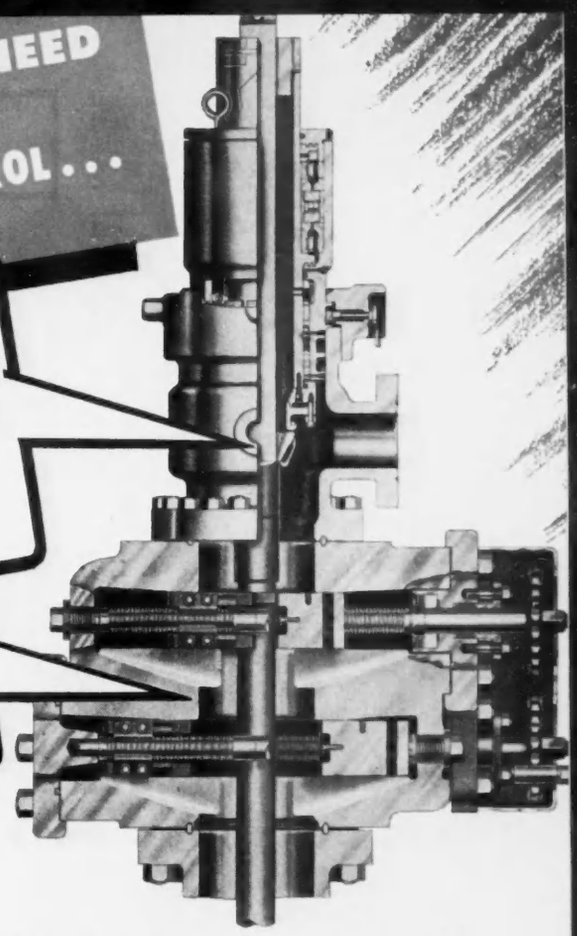
Thomas K. Bowles was named assistant chief geologist of The Ohio Oil Company with headquarters in the general offices at Findlay, Ohio. For the past three years, he has been performing specialized work for the chief geologist at Houston, where he studied and interpreted geologically the results of the company's gravity-meter surveys. In his new position, he will assist the chief geologist, **Paul L. Henderson,** in directing the general operations of the company's geological department. Bowles was employed by the company as a geologist in the California Division from 1929 to 1931, and began his permanent employment in 1934. He was made district geologist at Bakersfield, Calif., in 1938, remaining in that position until his assignment to Houston in 1945.

Thomas K. Bowles

HERE'S EVERYTHING YOU NEED FOR COMPLETE PRESSURE CONTROL . . .

THE SHAFFER COMBINATION ROTATING BLOW-OUT PREVENTER AND STRIPPER

THE SHAFFER DOUBLE CELLAR CONTROL GATE

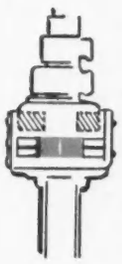


THAT'S right—this *one* compact Shaffer Hook-Up meets your every requirement for maximum safety, simplicity and wide-range adaptability. Check over its features. You'll find it unsurpassed for modern drilling operations . . .

PERMITS ROTATING UNDER PRESSURE—in both right or left hand directions. The Shaffer Combination Rotating Blow-Out Preventer and Stripper maintains its pressure-tight seal *continuously*, even around varying diameters and shapes. It seals off around the kelly, whether square, hexagonal or octagonal . . . and because the kelly and sealing unit rotate *together*—not one rotating inside the other—a tight seal is maintained with practically no wear while operating the kelly. Also, of course, the unit seals around any other portion of the rotating drill string with equal safety and simplicity!

SEALS WHEN RUNNING PIPE UNDER PRESSURE—both in and out of the hole. Adjustment of the Stripper Rubber to different diameters and shapes is completely automatic—no manual operations are necessary. In addition to the kelly, the unit automatically adjusts itself to seal off around all other elements* in the drill string—pipe, couplings, upsets, tool joints and drill collars. Therefore, no special sealing operations around the pipe are necessary when stripping it in or out or making connections, thus simplifying rig operations!

**Except such abnormally large diameters as bit or reamer.*



PROVIDES SHUT-OFF WITH PIPE OUT OF HOLE. The lower compartment of the Shaffer Double Cellar Control Gate is equipped with complete shut-off rams for closing open hole, thus permitting complete shut-off with pipe out of the well. All closing and opening operations can be made by the driller—or from any other desired location—with choice of air, hydraulic, steam or electric drives, *plus manual standby operation in case of power failure!*

PROVIDES DOUBLE SHUT-OFF WITH PIPE IN HOLE. The upper compartment of the Shaffer Double Cellar Control Gate is equipped with rams for closing around the pipe. This, in combination with the continuous seal provided by the Shaffer Combination Rotating Blow-Out Preventer and Stripper, provides *double* protection in pressure emergencies . . . a *double* safeguard for your well investment!

The above is only a brief outline of the *complete* pressure protection this Shaffer Hook-Up provides. The Shaffer Combination Rotating Blow-Out Preventer and Stripper is *fully automatic* in operation, maintaining its pressure-tight seal *continuously* around the various shapes and diameters in the drill string with no manual adjustments or attention of any kind. Pressure emergencies just can't happen too fast for this unit because it is *always* sealed off around the drill string as long as pipe is in the hole, *instantly* ready for pressure protection!

25 years OF OIL TOOL LEADERSHIP

And the Shaffer Double Cellar Control Gate closes off open hole and gives additional protection on even the most difficult pressure operations—*in a minimum of space.* Its positive mechanically-operated rams do not creep and require no "locking" or other secondary operations to hold them closed. They *stay* closed where they are set. Rams are quick and easy to change . . . ram compartments are self-draining, mud-free . . . and there are many other vital features!

No matter what your pressure control requirements, get the full Shaffer story before you decide. No other equipment provides *such* complete protection . . . in *such* compact space . . . with *such* positive, trouble-free dependability!

See the Shaffer section, pages 3843 to 3894, of your Composite Catalog!

Send for your free Shaffer Catalog!

SHAFFER

HIGH PRESSURE DRILLING AND CONTROL EQUIPMENT • FISHING TOOLS THAT EXCEL

SHAFFER TOOL WORKS, Brea, California • California Service Shops: Santa Fe Springs and Tor
HOUSTON, TEXAS, 6006 Navigation Blvd. • ODESSA, TEXAS, 1925 West Second Street
OKLAHOMA CITY, OKLAHOMA, Acme Oil Tool Company, 1001 S. E. 29th Street
EXPORT SALES OFFICE: Shaffer Tool Works, 500 Fifth Avenue, New York, N. Y., U.S.A.

DEATHS

A. Smith Dunnington, 79, veteran oil producer and drilling contractor, died at Tulsa December 5 after a brief illness. Born near Marietta, Ohio, he grew up in the environment of the oil industry and participated in oil plays in Ohio, Indiana, Illinois, Kansas, Oklahoma and North Texas. He was associated with the late **W. G. Selby,** founder of the Selby Oil and Gas Company, and went to Tulsa in 1928.

»

William Ungerman, 60, independent oil producer, died November 16, at Tulsa. A native of Russia, he came to the U. S. as a child, his family settling in Kansas City, Mo., where he later became president of the Consolidated Metals Corporation.

G. Gordon Brownell, 64, tax official of Cities Service Company, died November 30 at Westfield, N. J. Brownell held various positions with the Denver Gas & Electric Company from 1904 to 1910, when he joined Cities Service Company as manager of the Accounting department. In 1917 he was appointed manager of the Tax department, and served in that capacity until his death.

John H. Ford, 69, retired pipeliner, died December 3 at Tulsa as a result of automobile injuries. A native of Petrolia, Canada, he had been in the right-of-way department of Sinclair Oil Company at Drumright and Cushing, Okla., before moving to Tulsa in 1920. He later moved to Oklahoma City and prior to his retirement had been stationed in East Texas.

»

Edward J. Slater, 82, pioneer Oklahoma oil operator, died November 15, at Tulsa after a brief illness. He had been active in the early Keifer and Glenn pool booms and had retired several years ago as an oil field contractor and independent producer.

»

Joseph Hartman, founder of Imperial Oil & Gas Products Company, died at Pittsburgh October 25. He was chairman of the board of directors and president of the firm for 40 years.

»

Theodore M. (Ted) Cooper, 61, Oklahoma independent producer, died December 7 at Tulsa following a heart attack. He was a native of Cooper, Ky., and entered the oil business in Kentucky in his teens. He had resided in Tulsa for about 25 years and had engaged in drilling contracting and oil production in and around Tulsa until his retirement about three years ago.

»

Russell B. Clark, 48, West Orange, N. J., formerly with Phillips Petroleum Company at Tulsa, died November 12, after a heart attack. He moved from Tulsa to New Jersey about two years ago to become comptroller for the Suburban Propane Gas Company. He also served as comptroller for the Petroleum Institute of America.

»

Frederick G. Stodder, 53, independent Kansas oil producer, died November 14, at Wichita, Kansas, after a brief illness. He was a member of IPAA and was vice president for Kansas. He also was an active member of the Kansas Independent Oil and Gas Association.

»

Victor K. Ficher, 54, lubricating engineer with The Texas Company, died November 14, at Tulsa following a heart attack.

»

James D. Grant, 65, civil engineer for Humble Oil & Refining Company, died December 1 at Houston.

»

Harry W. Peter, 60, field superintendent for Merrick Oil Company, and W. A. Teague, drilling superintendent for the same firm, were killed when a derrick collapsed near West Columbia, Texas, November 25.

»

Thomas S. Holt, 76, founder of Holt Oil Company, died November 21 at Federalsburg, Md.

»

Joseph A. Tennant, 60, a consulting engineer who pioneered the recycling process, died December 14 at Houston.

»

Paul W. Steinberger, 59, veteran Oklahoma oil operator, died at Tulsa following a heart attack. A native of Erie, Kansas, he had resided in Tulsa 35 years.

PARAFFIN'S NO PROBLEM

when your sucker rods are equipped with

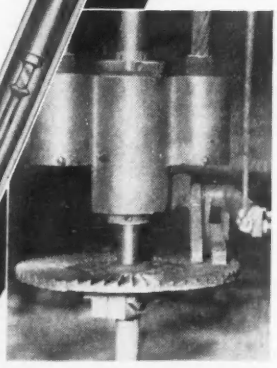
HUBER SCRAPERS

Paraffin can't accumulate in the tubing when your sucker rods are equipped with Huber Scrapers. NO PARAFFIN . . . NO TROUBLE . . . NO REMOVAL COSTS!

Huber Scrapers, shrink-fitted to new or used sucker rods, scrape paraffin from the tubing wall as the string rotates and reciprocates. This constant scraping prevents paraffin accumulation . . . eliminates paraffin removal.

Huber Scrapers quickly pay for themselves. Wells requiring paraffin removal every week or ten days have been on production for months without paraffin trouble after Huber Scrapers were installed.

If paraffin's a problem, install Huber Scrapers. Write for descriptive bulletin.



HUBER ROTATING ROD HANGER

This rod hanger rotates the rod string a fraction of a turn on each reciprocation. The horizontal teeth on the turn table are engaged by two ratchet levers which are actuated by a flexible steel cable attached to the walking beam. On each reciprocation the levers move the rod string a fraction of a turn.

SOLD THROUGH SUPPLY STORES

J. M. HUBER CORPORATION
P. O. BOX 831 BORGER, TEXAS

HUBER
PARAFFIN SCRAPERS
SCRAPE AS THEY ROTATE AS THEY RECIPROCATE

WORLD OIL's 24-month record of paid subscriber circulation

1946	TOTAL	
November	15,398	
December	15,515	
1947		
January	15,772	
February	15,968	
March	15,865	
April	16,216	FIRST TIME OVER 16,000
May	16,076	
June	16,255	
July	16,426	CHANGE TO MONTHLY ANNOUNCED
August	16,510	
September	16,532	
October	16,797	FIRST MONTHLY ISSUE
November	16,783	
December	17,001	NEW ALL-TIME HIGH IN THE 31-YEAR HISTORY OF PAPER*
1948*		
January	17,086	"ditto"
February	17,295	"ditto"
March	17,354	"ditto"
April	17,629	"ditto"
May	18,332	"ditto"
June	18,685	"ditto"
July	18,714	"ditto"
August	18,841	"ditto"
September	18,893	"ditto"
October	19,276	"ditto"

* These figures do not include single copy sales.

EQUIPMENT AND SERVICE SUPPLIERS' NOTES

Schlumberger Receives Trophy For Safe Export Shipments

Schlumberger Well Surveying Corporation and Carl A. Johnson, Schlumberger export expeditor, were awarded the William H. McGee and Company trophy in the first annual national competition among companies engaged in export business. The award was given for having the lowest percentage of lost or damaged export shipments during the past year.

With export shipments which totaled nearly $1½ million to countries throughout the world, Schlumberger reported a loss of only $87.18. The shipments involved more than 1600 boxes which ranged in size from radio tubes to complete Schlumberger truck units.

The William H. McGee Company, marine underwriters, began the export crating and shipping competition to encourage better and sturdier packing for foreign shipments.

The McGee company announced the competition in connection with the annual convention of Industrial Packing Engineers' Association, a national association with representation from all large export shippers.

The McGee award, a gold trophy with a large base simulating an export package, will remain in the possession of Schlumberger for one year.

Ed Koberg Promoted to Houston Headquarters of Byron Jackson

E. R. (Ed) Koberg, Baton Rouge sales engineer for Byron Jackson Company, Oil Tool Division, has been promoted to the company's Mid-Continent headquarters at Houston. Koberg, who has been with BJ for five years, was replaced by D. M. Mundinger, who went to BJ from Stone & Webster.

Koberg spent eight years with The National Supply Company and then opened the sales office for Murry-Brooks, Inc. in New Orleans.

Ammann Photogrammetric Firm Opens Office in New York

Jack Ammann Photogrammetric Engineers of San Antonio has opened an Eastern office at 34 Webster Avenue, Manhasset, New York.

William H. Meyer, Jr., who has been engaged in this type of work since 1927, will be the manager.

Southwest Representative Chosen By Billings & Spencer Company

Luther J. Westbrook has joined Billings & Spencer Company and will reprecent the Billings line of wrenches and shop tools in the Southwest with headquarters in Bellaire, a suburb of Houston.

Westbrook was discharged from the Army as a major in the Combat Intelligence Division. He was formerly on the planning and research staff of a Houston oil refining company.

C. F. ter Weele Appointed Export Manager for Farrel-Birmingham

Carl F. ter Weele has been made export manager of Farrel-Birmingham Company, Inc., with headquarters at the company's New York office in the Chrysler Building.

His first business association was assistant to the administrator of a large tea factory in the Dutch East Indies and assistant fabrication chief in a tea plantation. After his return to Europe he was made president of the Croca Company, Bruxelles, Belgium, and later became associated with the export sales division of Philips-Eindhover, manufacturers of radios and electrical equipment.

Ter Weele was an officer in Royal Netherlands Army during the invasion of 1940 and afterwards escaped the country. He has been connected with Remington Rand, Inc.

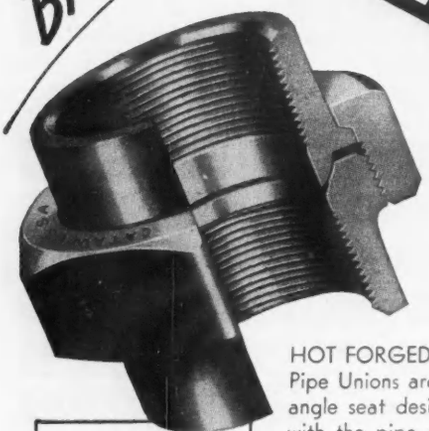
Training Program Planned

An enlarged program of instruction, with emphasis on the selection and application of correct instrumentation for specific industries, in addition to training in the use and maintenance of instruments in general, is planned by The Foxboro Company. For full information address: Director of Training, The Foxboro Company, Foxboro, Mass.

CATAWISSA

BALL-TO-ANGLE SEAT

gives you a PERFECT SEAL...



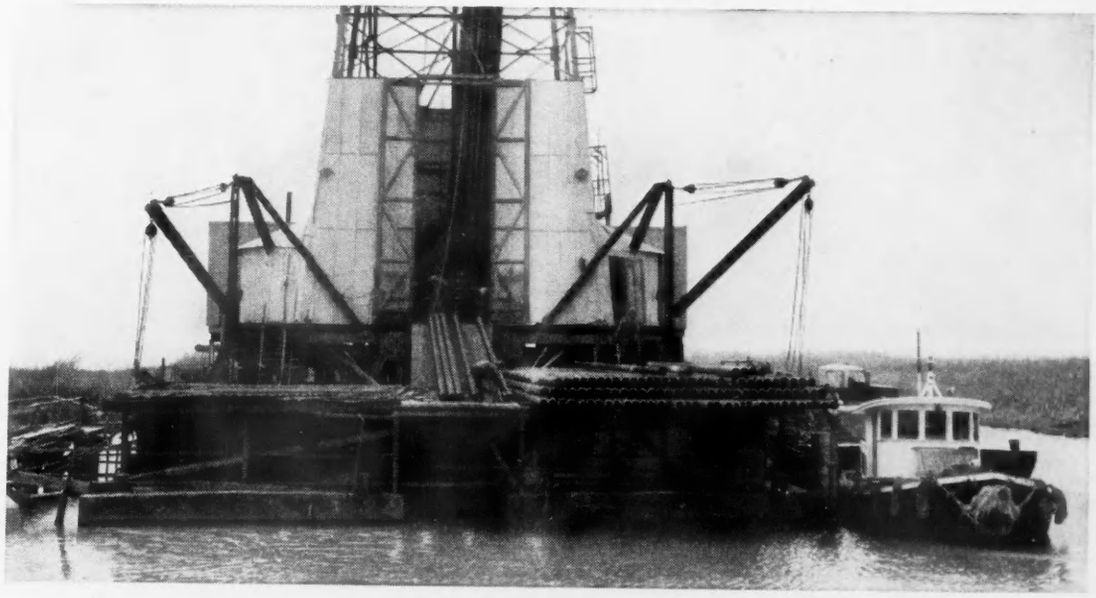
...even when the pipe is not perfectly aligned!

HOT FORGED from solid, rectangular steel bars, Catawissa Pipe Unions are free from sand and blow holes. The ball-to-angle seat design plus their ability to expand and contract with the pipe give you sure fire dependability . . . a perfect seal for every application!

HOT FORGED STEEL
STAINLESS STEEL
Full ACME Threads or U. S. V-Threads in Union nuts and on female end.
STANDARD AND DOUBLE EXTRA HEAVY

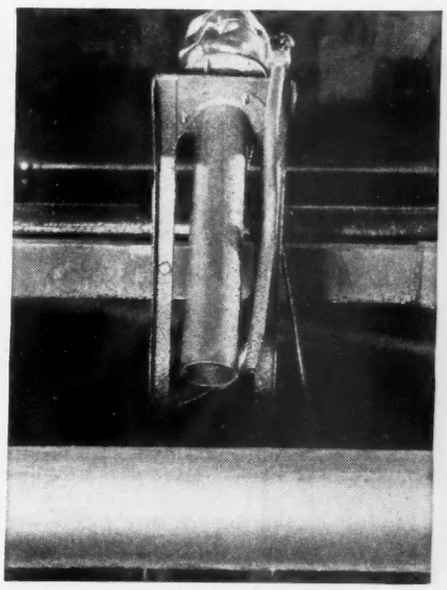
DISTRIBUTED BY
OIL WELL SUPPLY COMPANY
BRANCHES SERVING ALL OIL FIELDS
WRITE FOR BULLETIN 10-A
CATAWISSA VALVE & FITTINGS COMPANY CATAWISSA, PENNA.

DEPENDABILITY THROUGH



IN A SOUTHERN FIELD: A 10,000-foot string of 7-inch S-80 and S-105 SMITHway Casing being run in the bayous of Louisiana.

RESEARCH AND ENGINEERING

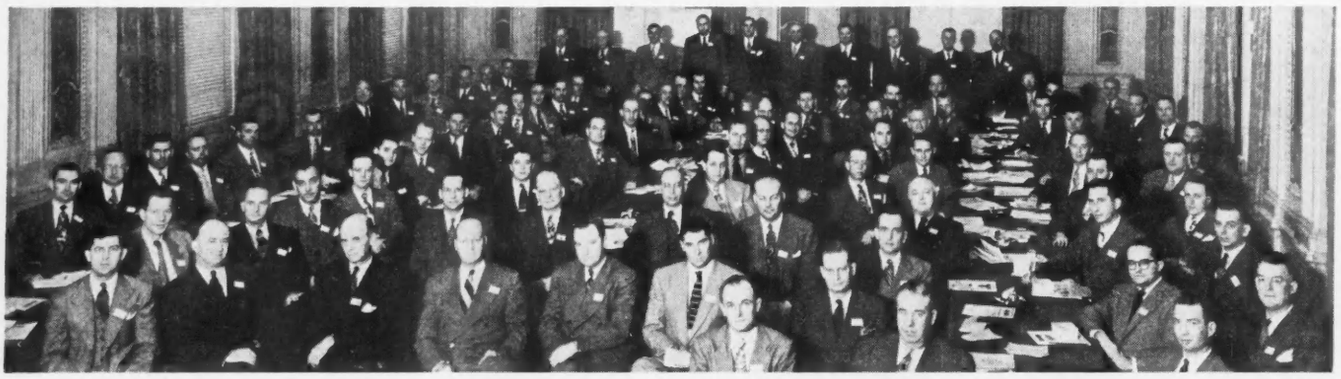


IN THE A. O. SMITH PIPE MILL: This equipment is used for measuring and controlling Casing temperature for certain manufacturing processes.

SMITH*way* CASING · LINE PIPE

A. O. SMITH CORPORATION

New York 17 • Pittsburgh 19 • Atlanta 3 • Chicago 4 • Tulsa 3 • Dallas 1
Houston 2 • Seattle 1 • Los Angeles 14 • International Division: Milwaukee 1



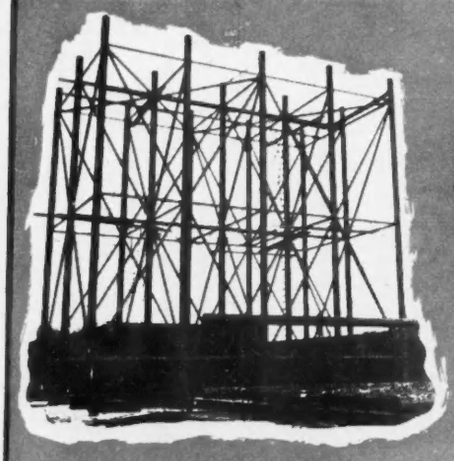
33RD ANNUAL SALES MEETING—More than 90 salesmen from Thompson-Hayward Chemical Company's 18 branch offices and warehouses attended a sales meeting at Kansas City, Mo., November 21-23. Thompson-Hayward is a basic distributor of industrial and agricultural chemicals; and also manufactures numerous agricultural and specialty products. Indicated sales volume for 1948 will exceed that of 1947 and will be in excess of $12 million.

Manly Succeeds Meyer as Manager Of Dealer Sales for Allis-Chalmers

W. L. Manly has been appointed manager of dealer sales of the Allis-Chalmers Manufacturing Company, succeeding W. A. Meyer, who has been named assistant manager of the Texrope Drive department.

Manly has been with Allis-Chalmers since 1937, serving in the water conditioning department, where he has been manager since 1942. Meyer successively served in the Allis-Chalmers milling machinery, Texrope, and central sales departments, and was manager of general purpose equipment sales before he assumed charge of the A-C dealer organization.

T. J. Hodan, water conditioning department sales representative in the Milwaukee district office since July, 1942, succeeds Manly as manager of the company's water conditioning department. Before joining Allis-Chalmers six years ago, Hodan was employed by Pflugradt Company and Everett Smith Automatic Temperature, Inc., both of Milwaukee.



AVONDALE'S ANSWER

TO YOUR OFFSHORE

DRILLING PROBLEMS!

AVONDALE has fabricated these pipe jackets for J. Ray McDermott & Co., Inc., to build platforms for drilling oil wells in the Gulf. For dependable marine equipment construction... Consult

AVONDALE MARINE WAYS, Inc.

River Front: New Orleans District
Mailing Address: Westwego, La.

Main Plant: Avondale, La.
Quick Repair Plant: Harvey, La.

Bethlehem Opens New Store, Announces Personnel Changes

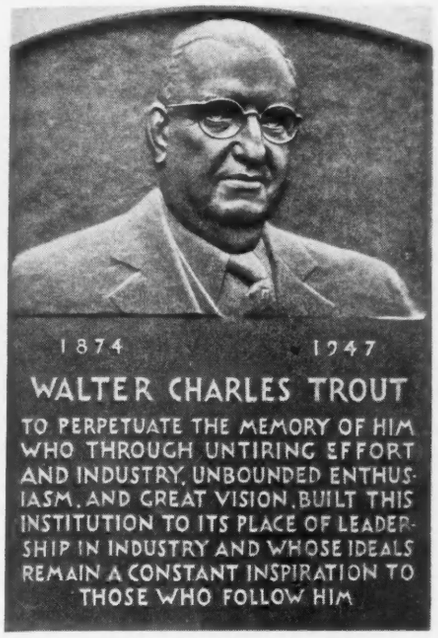
Bethlehem Supply Company announced the opening of a new store at Cisco, Texas, and following personnel changes: Jack Morris, formerly store manager and field representative at Wichita Falls, Texas, has been transferred to Cisco in the same capacity; C. A. Pigg, formerly at the Bowie, Texas, store has been transferred to Cisco and will concentrate on sales work; M. E. McKelvey, formerly assistant store manager at Wichita Falls, has been promoted to store manager; J. W. Haney has been promoted to field representative and will work out of the Wichita Falls store; C. L. Leger, who recently joined Bethlehem as field representative, is now located at the New Iberia, La., store; B. W. Peoples is now affiliated with Bethlehem as field representative in the Odessa, Texas, store.

Warren Miller Chosen Division Manager for Mud Products Firm

Warren Miller has been appointed division manager of Mud Products, Inc., Tulsa, in the Kansas, Colorado and Panhandle area. Before joining Mud Products, Miller was vice president and partner of the Black Supply Company, of Wichita, Kansas. He began his career in 1925 with The National Supply Company and served with that organization until 1932, when he joined the Bovaird Supply Company

Warren Miller

W. G. Vickers was added to the sales and engineering staff, and with headquarters at Henderson, will cover the southeast Texas area and parts of Louisiana. Vickers served 14 years in the field in drilling and production. Before joining Mud Products he was with Baroid in the Specialty department.


1874 1947
WALTER CHARLES TROUT
TO PERPETUATE THE MEMORY OF HIM WHO THROUGH UNTIRING EFFORT AND INDUSTRY, UNBOUNDED ENTHUSIASM, AND GREAT VISION, BUILT THIS INSTITUTION TO ITS PLACE OF LEADERSHIP IN INDUSTRY AND WHOSE IDEALS REMAIN A CONSTANT INSPIRATION TO THOSE WHO FOLLOW HIM

This plaque to the memory of Walter Charles Trout, late president of Lufkin Foundry & Machine Company, was dedicated by employes of the company November 24 at Lufkin, Texas.

B & W Entitled to Make and Sell Spiral Centralizer, Court Rules

The U. S. Federal Court for the Western District of Louisiana has rendered a decision in the case of Jesse E. Hall vs. B & W, Inc., which was tried at Lake Charles in May. Judge Gaston Porterie, in a decision of November 5, dismissed the action for infringement of Hall patent 2,220,237 for a spiral centralizer, holding that the defendant, B & W, Inc., was entitled to manufacture and sell the same.

B & W, Inc., manufactures and sells scratchers and straight centralizers as well as spiral centralizers. B & W scratchers and straight centralizers were not involved in the litigation. The effect of the decision is that B & W, Inc., may manufacture and sell both straight and spiral centralizers free from any claim of Jesse E. Hall who is doing business under the firm name and style of Weatherford Spring Company.

Sales Departmental Engineer Named by Fluid Packed Pump

John R. Brennan has been appointed sales departmental engineer for Fluid Packed Pump Company. Brennan has a Bachelor of Science degree in chemical engineering from Oregon State College and spent 12 years with the Union Oil Company as field engineer and production foreman. He will headquarter in California but will be subject to assignments throughout the company's entire scope of operations.

Penflex Expands Staff

Lionel Tinflow, sales engineer, has been added to the New York staff of Pennsylvania Flexible Metallic Tubing Company. He will be under the supervision of Sidney V. Winton, New York branch manager of Penflex.

Ryerson Begins Construction Of Addition to Chicago Plant

Joseph T. Ryerson & Son, Inc., Chicago steel firm, has begun construction of a brick and steel addition to the Chicago plant which will provide approximately 118,000 square feet of modern plant and office space. Completion is scheduled for November, 1949. This is the initial move in a series of planned additions and improvements which, according to President Everett D. Graff, will ultimately result in large-scale expansion and modernization of the entire Chicago property.

The new building, an L-shaped structure, will be erected at 15th and Rockwell Streets, becoming a part of what is known as the north unit of the three-block plant, and extending east along 15th Street from Rockwell Street to the Pennsylvania Railroad, a distance of 470 feet. Construction includes a two-story office building an integral part of the plant addition, which forms part of the new structure of 200 feet on Rockwell Street, and which will provide about 12,000 square feet of office space.

DAN L. CLARK W. M. AVERILL RUPERT COX

DAN L. CLARK
DRILLING
COMPANY

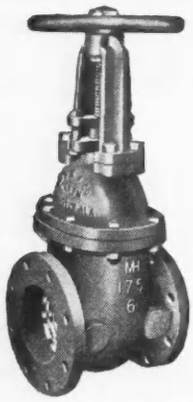
Drillers of
OIL AND GAS WELLS

POWER
AND
STEAM
RIGS

WILSON BUILDING
CORPUS CHRISTI, TEXAS

Telephones
Local 7746—7747 Long Distance 95

"Red Wheel"
VALVES, HYDRANTS
And Pipe Line Accessories



M & H valves for water, gas, steam, oil, chemicals, are furnished in all commercial sizes from 2" to 30", inclusive. They are cast iron body, bronze mounted, furnished double disc parallel seat or solid wedge. They are heavily proportioned and have a high factor of safety.

A. W. W. A.
HYDRANTS
Underwriters Approved

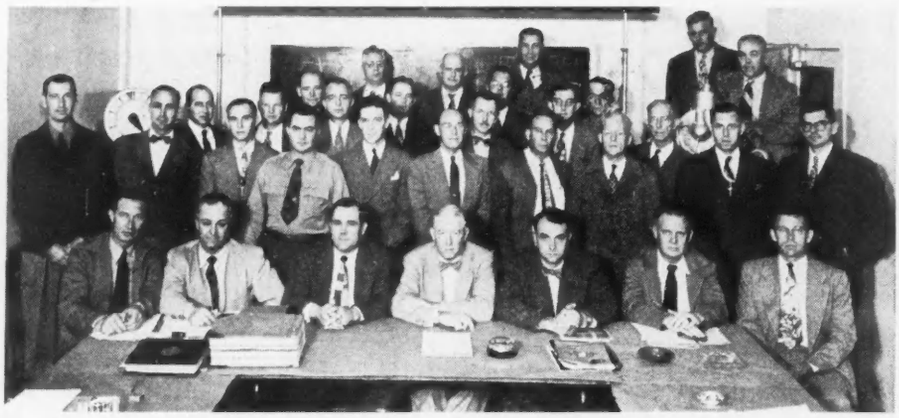
Conform to American Water Works Association Specifications. Approved and listed by Underwriters' Laboratories and Associated Factory Mutuals. Well known and widely used for many years.

SPECIAL TRAFFIC MODEL is designed to yield at ground line under impact, repair being simply renewal of breakable bolts and breakable coupling on stem. High efficiency because barrel diameter not reduced and there are no working parts or obstructions in waterway.

OTHER M & H PRODUCTS

Fire Hydrants
Gate Valves
Tapping Valves
Special Castings
Tapping Sleeves
Check Valves
Floor Stands
Extension Stems
Mud Valves
Flap Valves
Sludge Shoes

M&H VALVE
AND FITTINGS COMPANY
ANNISTON, ALABAMA



CAMERON SALESMEN MEET—The Cameron Iron Works sales staff met November 15-16 at the Cameron plant on Katy Road, Houston. They were introduced to the new Cameron line of forged steel well heads and the new Cameron Flo-Seal Gate-Plug Valves designed for general oil field and refinery service. The sales meeting was climaxed by an informal dinner party at Ye Old College Inn. Front row: Roy Davis, Jeff Musolf, R. F. Farmer, E. L. Lorehn, H. Allen, I. M. Baker, F. H. Isaacks. First row, standing: A. L. Scharck, Gene L. Teer, J. P. Wood, W. I. Sykes, R. W. Gustine, D. W. Townsend, I. E. Moses, X. R. Showers, Homer E. Brown, Joe Tennant. Second row, standing: J. B. Ray, M. L. Hooks, G. L. Duwe, Geo. Myers, J. R. Jerabeck, D. V. Clemons, S. S. Raimer. Third row, standing: A. A. O'Connor, J. A. Collet, C. Potts, Frank Graham, H. A. Calvert, R. G. Branch, Morey Zorgdrager.

Bill Griffin Becomes Sales Manager for Camco at Houston

Wilber H. (Bill) Griffin has become sales manager for Camco, Inc., gas lift equipment firm with headquarters in Houston. He assumed his new duties December 16. Griffin has been with Baker Oil Tools, Inc. since 1936, serving in various sales and service capacities. At the time of his resignation he was division sales engineer and also in charge of Baker's export department at Houston.

W. H. Griffin

Griffin took his petroleum engineering work at the University of Houston. Between 1928 and 1935, he served various oil companies and drilling contractors in California as a roustabout, rotary helper, derrickman and then as driller. In 1935, he entered the oil field equipment sales business, being associated with Dean Core Drill and Jack Smith Sales Company previous to joining Baker.

Bethlehem Supply Company Announces Sales Promotions and Transfers

O. N. Wilson, formerly field representative for Bethlehem Supply Company at the El Dorado, Kansas, store, has been promoted to store manager and field representative.

C. A. Pigg, formerly store manager and field representative at the deactivated Bowie, Texas, store, has been transferred to the new Cisco, Texas, store in the same capacity.

Glen Cannon, formerly special representative at the Pampa, Texas, store, has been transferred in the same capacity to Artesia, N. M.

P. H. Jezzard, a trainee in the engineering sales department of the general offices, has been transferred to Casper, Wyo., and promoted to district engineering representative.

Carl Taylor, field representative at Craig, Colo., has been transferred to Casper, Wyo., in the same capacity.

T. V. Ashabranner has been transferred from Kilgore, Texas, to Shreveport, La., and promoted to field representative.

H. L. Daniels, formerly field representative at Lake Charles, La., has been promoted to store manager and field representative.

C. A. Claudet in the Harvey, La., store and A. D. Waddell in the Odessa, Texas, store have been promoted to field representative at their respective locations.

C. W. Henry has joined Bethlehem as a special representative and will work out of the Pampa, Texas, store.

Detroit Seamless Tube Company Bought by Glenn McCarthy

Glenn McCarthy, Houston oil man, has purchased the 400-ton-a-month Detroit Seamless Tube Company, formerly an affiliate of Sharon Steel Company. It will be operated by the McCarthy International Tube Corporation, and will manufacture steel pipe from one-half to 5½ inches in diameter. Later the plant will be expanded to make larger pipe, to be used primarily in the oil industry.

Other officers of McCarthy International Tube Corporation are Lou Roberts, vice president, and James L. Purdue, secretary.

Vaughn Firm Moves

The B. M. Vaughn & Company, manufacturers agents and engineers, will move into their new Houston office and warehouse at 2912 Crawford Street by January 1. The building will be strictly modern and all equipment will be of the latest type.

EQUIPMENT and SERVICE SUPPLIERS' NOTES

Vice President and Comptroller Appointed by Oil Well Supply

Ralph W. Rager was elected vice president of Oil Well Supply Company, U. S. Steel subsidiary, and Erwin P. Kraatz was named comptroller.

Rager, who has been comptroller since October, 1944, will be administrative assistant to the president. He joined "Oilwell" as an accountant in 1936, was made general accountant in 1938, and assistant comptroller in 1941. During the war, he was also in charge of manufacturing accounting for the company's Eastern plants.

Ralph W. Rager

Erwin P. Kraatz

Kraatz has been senior assistant comptroller since last October 1. He became connected with Oil Well Supply in 1937. In 1940 he was made general accounting supervisor. In 1942 he entered the Navy as an ensign in cost inspection, and was separated in 1946 as a lieutenant commander in charge of all cost inspection in the Mobile, Ala., area. Returning to Oil Well, he was named assistant to the comptroller in Dallas, and in 1947 was transferred to Oil City, Penn., as assistant comptroller in charge of accounting for the company's Eastern plants and export office.

Hewitt Rubber Division Appoints District Manager at Houston

John W. Pew has been appointed district manager of the Houston office of Hewitt Rubber Division, Hewitt-Robins, Inc.

Pew joined the Hewitt organization in 1936 as a factory employe. The following year he was transferred to the company's laboratory, remaining there until 1941, when he entered the armed services. He returned to Hewitt in 1945 and became a member of the sales staff. He was transferred to the Chicago office as a sales representative in 1946.

He will be assisted in his new post by Don Burge, recently named a Hewitt sales representative.

Representative in Chicago Area Appointed by Cannon Electric

Leroy W. Beier has been appointed manufacturers representative at 600 South Michigan Avenue, Chicago 5, to represent Cannon Electric Development Company of Los Angeles in the Chicago trading area. His territory will include northern Indiana counties, northern Illinois, and eastern Iowa, for the Cannon plugs, solenoids, and electrical specialties.

Guaranteed

PIPE WRENCH ECONOMY

No pipe wrench housing repair or expense with RIDGID

UNCONDITIONAL GUARANTEE
If this Housing ever Breaks or Distorts we will replace it Free
THE RIDGE TOOL CO.
ELYRIA, O.
RIDGID
TRADE RIDGID MARK PAT. 1727C

Attractive new RED Finish!

The famous RIDGID guarantee is just one of the features that make RIDGID the outstanding favorite of millions. You also like the free-spinning adjusting nut, handy pipe scale on the hookjaw, the comfort-grip I-beam handle with flared end that keeps your hand from slipping off. For real efficiency and guaranteed economy, buy RIDGID wrenches, 6" to 60," at your Supply House.

RIDGID

WORK-SAVER PIPE TOOLS

THE RIDGE TOOL CO. • ELYRIA, OHIO

Worthington Pump Takes Over Activities of Subsidiary

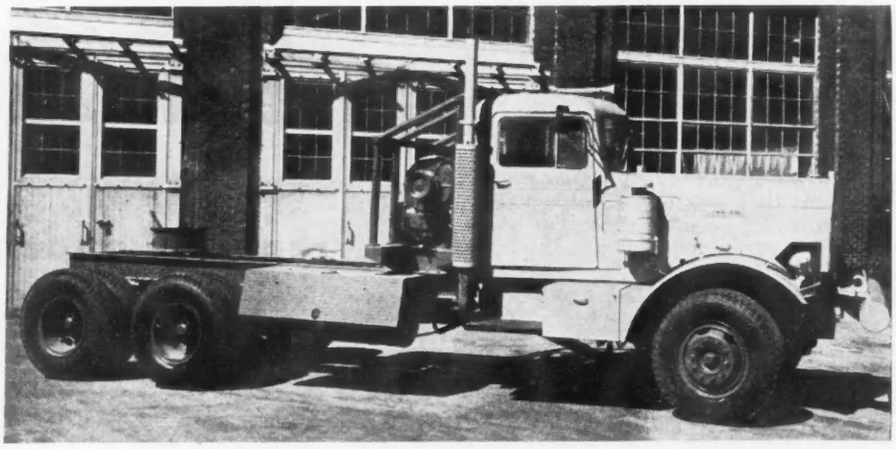
Worthington Pump and Machinery Corporation announced that beginning November 29, the manufacturing and distributing activities of its subsidiary, Ransome Machinery Company, would be conducted by the parent corporation.

Manufacturing operations for the lines previously manufactured by Ransome will be carried on at Worthington's Dunellen Works, Dunellen, N. J., the same location formerly used by Ransome Machinery Company. Sales activities will be directed from Worthington's executive offices at Harrison, N. J., through the Ransome Sales Division located at the Dunellen Works.

Lorain Works Hits New High in Production of Steel Ingots

The Lorain Works of National Tube Company in November reached an all-time high in the production of steel ingots, topping by a sizable margin the record set in the previous month.

The ingot total of 166,250 tons is one of four major new records chalked up at the plant in November, surpassing by 2571 tons the October steel tonnage turned out by this plant's 12 open hearth furnaces aand two Bessemer converters.



EXPLORATION BOUND — This big Kenworth Model 548 truck was especially designed by Kenworth Motor Truck Corporation of Seattle to do an oil exploration job in Venezuela for the Richmond Exploration Company of San Francisco. Included in the special equipment on this truck is a Braden Winch having a capacity of 100,000 pounds. The vehicle is powered by a 200-horsepower Cummins diesel engine.

Haslup Appointed

Charles L. Haslup has been appointed sales manager of field operations for the Reading-Pratt & Cady Division of American Chain & Cable Company, Inc., with headquarters at Reading, Penn.

D. G. Weekes Appointed District Manager by Continental Supply

D. G. Weekes has been appointed district manager of tubular sales for Continental Supply Company, Dallas, in North Texas and West Texas-New Mexico, with headquarters at Fort Worth.

He joined the Youngstown Tubular Division of Youngstown Sheet and Tube Company in 1945, soon moving to Texas as field representative. He served in this capacity until his recent employment by Continental.

A. H. Knight Appointed Sales Manager Of Franks Manufacturing Corporation

A. H. Knight has been appointed sales manager for Franks Manufacturing Corporation at Tulsa. Knight formerly was affiliated with Oil Well Supply Company and for the past 18 months had been with the International Derrick and Equipment Company.

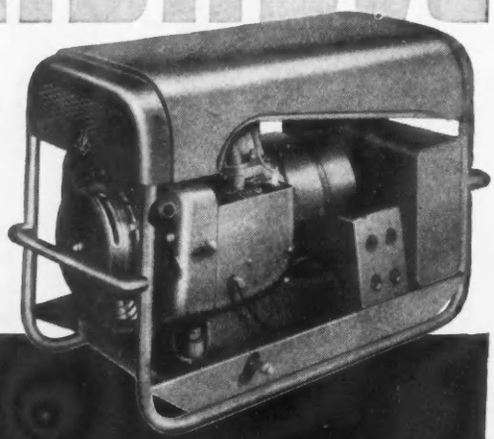
Hans Bohuslav Named Engineering Consultant to R. G. LeTourneau

Hans A. Bohuslav has been appointed a special engineering consultant to R. G. LeTourneau, president of R. G. LeTourneau, Inc., Peoria, Ill., and Longview, Texas. Born in Dresden, Germany, Bohuslav's early engineering training was received in the technical schools of that country. From 1933 to 1942 he served Enterprise Engine & Foundry Company as chief engineer and later as vice president in charge of engineering. From 1942 to 1947 he was with Sterling Engine Company. His headquarters will be at Longview, Texas.

Hans A. Bohuslav

DEPENDABLE

LIGHT & POWER
for Oil Field Service



AIR-COOLED HEAVY-DUTY
ONAN "CK"
ELECTRIC PLANTS

Available in A.C. or D.C. models, conservatively rated at 3,000 watts, built for heavy-duty service but compact and light in weight (only 315 lbs.), Onan CK Electric Plants are replacing bulky, heavier units for drill rigs, well-servicing and other oil field uses. Equipped with convenient carrying frame for easy moving on the job. Driven by the Onan 10 hp, 2-cylinder opposed, air-cooled CK engine with Onan heavy-duty generator direct-connected. Self-rewinding Readi-Pull starter included as standard equipment. Other models available with manual, Readi-Pull or electric starting. Plug-in receptacles. Weather hood, hinged for easy servicing, protects plant.

Models for every oil field job

Lightweight: 500 to 3000 watts

Gas-gaso-powered: 3 to 35KW

Diesel Plants: 2½ to 35KW

Onan PRODUCTS

Heavy-duty, one and two-cylinder air-cooled models. Two, four and six-cylinder water-cooled models. Gas-gaso-powered: 350 to 35,000 watts. Diesel-powered: 2,500 to 35,000 watts.

Write for Folder

D. W. ONAN & SONS INC.
5345 Royalston Ave. Minneapolis 5, Minn.

EQUIPMENT and SERVICE SUPPLIERS' NOTES

Joe E. Ross Becomes Owner of Flow Measurement Company

Joe E. Ross has obtained ownership of the Houston Flow Measurement Company. The firm specializes in integrating all types of meter charts and is also equipped to inspect, repair and calibrate positive displacement and orifice measurement equipment as well as automatic controls.

Joe E. Ross

Ross is a graduate petroleum engineer from the University of Texas, and with the exception of the war years, when he served in the Navy, he was with United Gas Corporation's Operating Division since 1940. His offices are in the Southern Standard Building, Houston.

Vice President and Director Of Sales Appointed by Bowser

Fred S. Ehrman, general sales manager of Bowser, Inc., has been elected to the new post of vice president and director of sales.

Ehrman has been associated with Bowser, Inc., since 1925, and has served successively in experimental engineering, sales engineering and divisional sales work.

Southwestern Representative Selected by Aeroquip Sales

S. R. Billingsley has been appointed sales engineer of aircraft sales in the Southwest for Aeroquip Sales and Engineering, Inc., of Fort Worth. Billingsley went to Aeroquip from Mid-Continent Supply Company, where he was representative for Fawick clutches in the Mid-continent area.

He was graduated from Texas A&M College with a degree in aeronautical engineering. During the war he was an officer in the artillery and after leaving the service was employed by Consolidated Aircraft Corporation.

Chain Belt Opens Warehouse at Atlanta to Serve Southeast

Chain Belt Company of Milwaukee has established a warehouse at 878 Ashby Street, N. W., Atlanta. The Atlanta district office will be at this address under the direction of J. S. Moore, district manager. The warehouse will be under the supervision of G. J. Schuelke, formerly of the Milwaukee office.

The warehouse will serve the entire Southeast, including North Carolina, South Carolina, Virginia, Georgia, Florida, and Alabama. A 24-hour delivery service will be available to most parts of the territory served. This warehouse will be used to give better service to Chain Belt Company customers and to aid Rex and Baldwin-Rex Distributors in serving their customers faster and with a more complete, readily available, line of Chain Belt Company products.

The P. A. was Amazed!

In 1945, *the Purchasing Agent of a large oil refining company bought 18 Helicoid Pressure Gages —to try them out.*

In 1946, he bought 475.

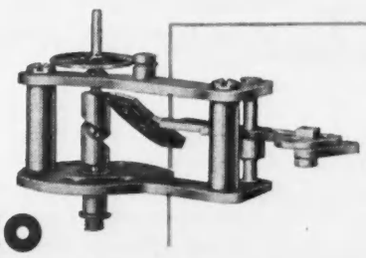
In 1947, he bought 1569.

In the first 3 quarters of 1948, he bought 1466.

But what amazed the P. A. was that with a total of 3528 Helicoid pressure gages—some of them up to 3 years old—he has had to buy *no repair parts* for replacement.

Ordinarily, for conventional spur-geared movement gages, he would have had to buy large quantities of spare movements and other spare parts.

Yes, the P. A. was amazed, and pleased. He had found out how Helicoid gages reduce maintenance costs.



Only Helicoid Pressure Gages have the Helicoid Movement

ACCO

HELICOID GAGE DIVISION
AMERICAN CHAIN & CABLE
Bridgeport 2, Connecticut

TRADE MARK

Four Wheel Drive Auto Company Reorganizes Sales Department

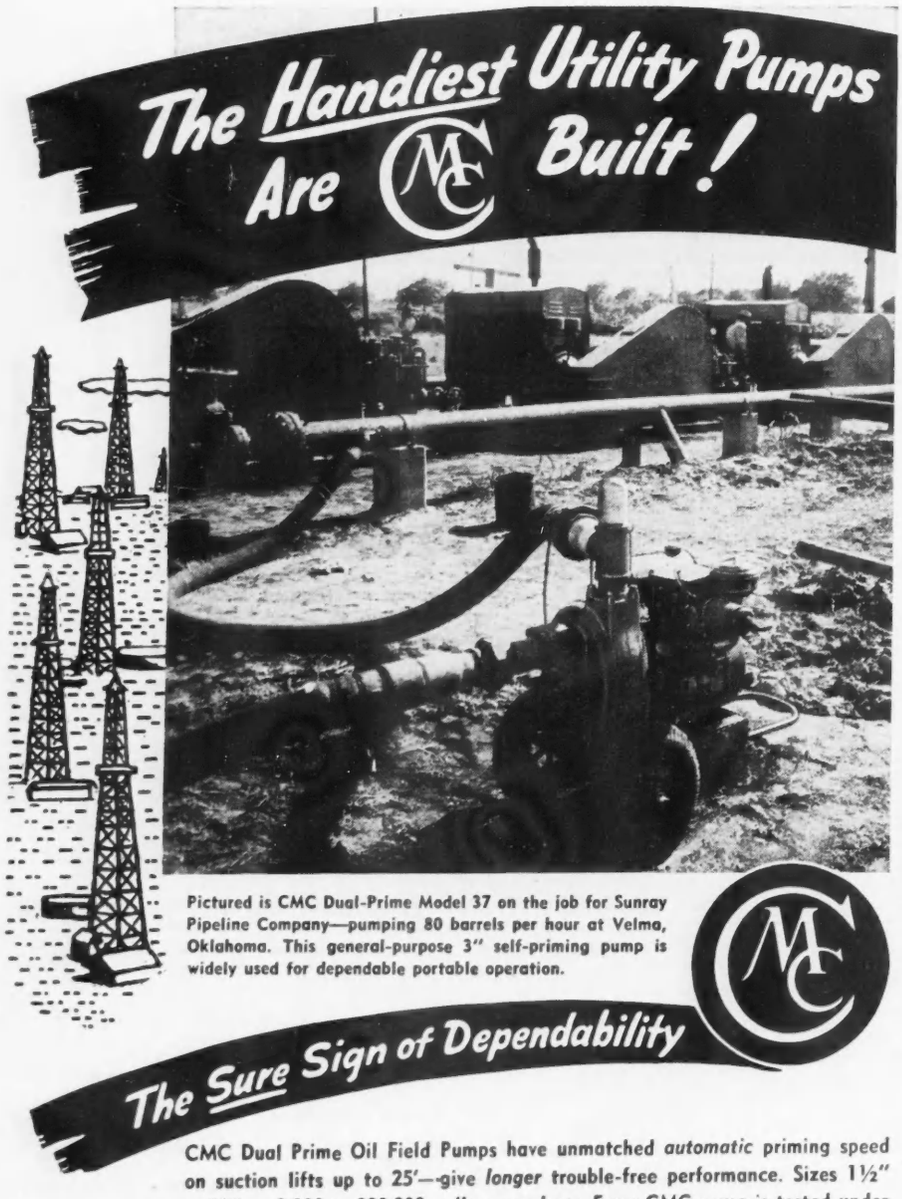
A. E. Johnson, formerly assistant field sales manager of Four Wheel Drive Auto Company, has been named supervisor of government sales. C. A. Rogers, who has specialized in fire truck sales for FWD, has been named supervisor in this market. Lloyd Schneider, formerly assistant to FWD's general manager Robert A. Olen, has been named supervisor of defense sales.

Roy Peterson, whose work has dealt particularly with the oil field market, has been named supervisor in this market. C. C. Cooke, formerly administrative assistant to the director of sales, has been named supervisor of the Order department.

For the development of new markets, particularly the contract market and over-the-road haulers, Leo Polzin, formerly field sales manager, has been appointed manager of national accounts. Polzin will concentrate his efforts in Wisconsin for the time being and will develop a sales organization for handling these new markets.

Stanley Wick, formerly manager of the Order department, has been appointed assistant director of sales in charge of all office domestic sales activity; and Jack Kelly, formerly assistant field sales director, has been appointed assistant director of sales.

Two new appointments were also made by FWD in its geographical field organization. John Battes, who for the past three years has been sales supervisor in Northern California and Idaho has been named acting manager of the Western sales zone. He succeeds Paul Schmidt. Howard Collard, formerly sales supervisor in Oregon and Washington, has been named acting zone manager in the southeastern states.


The Handiest Utility Pumps Are CMC Built!
Pictured is CMC Dual-Prime Model 37 on the job for Sunray Pipeline Company—pumping 80 barrels per hour at Velma, Oklahoma. This general-purpose 3" self-priming pump is widely used for dependable portable operation.
The Sure Sign of Dependability
CMC Dual Prime Oil Field Pumps have unmatched automatic priming speed on suction lifts up to 25'—give longer trouble-free performance. Sizes 1½" to 10" — 3,000 to 200,000 gallons per hour. Every CMC pump is tested under most severe conditions. For greatest economy and the best all-around pump performance insist on CMC. Write today. Our qualified engineers are ready to help you.
CONSTRUCTION MACHINERY CO'S.
WATERLOO, IOWA, U.S.A.
1903 Blodgett St., Houston, Texas
TELEPHONE HADLEY 5988

San Joaquin Valley Sales Manager Appointed by Waldrip Engineering

Jack Hampton has been appointed manager of sales and service in the San Joaquin Valley district for Waldrip Engineering Company.

Jack Hampton

From 1922 to 1927 he was with Shell Oil Company at Ventura, working in both the Drilling and Production departments as roughneck, well puller, and driller. He later was with California Petroleum Company, Union Oil Company and The Texas Company as driller. Then he sold production pumps and gas anchors for Hofco Pump Ltd., and in 1940 set up a store and shop for Fluid Packed Pump Company in Taft.

John Bergan to Head New Department Of Minneapolis-Honeywell Company

John R. Bergan has been named to head a new department of the Minneapolis-Honeywell Regulator Company which will supervise and coordinate the advertising, merchandising and sales promotion activities of the company. Chandler Murphy has been promoted to advertising manager and John A. Young to sales promotion manager. Murphy succeeds William B. Walrath, who has resigned to join the Chicago advertising staff of Fortune magazine.

Mid-Continent Announces Personnel For New Store at Duncan, Okla.

Ken W. Davis, president and general manager of Mid-Continent Supply Company, main offices in Fort Worth, has announced the personnel for Mid-Continent's new store at Duncan, Okla.

The store, located at North 7th and Main Streets, will be managed by J. H. Mackey, former store manager at Eunice. Field salesmen are W. E. Levell, formerly at Gainesville, and Bill Thornton, formerly at the Sundown store. Other personnel includes B. J. Hickman and H. V. Harris. The store is under the supervision of N. W. Dail, district manager at Wichita Falls.

EQUIPMENT and SERVICE SUPPLIERS' NOTES

E. R. Gilmore

C. B. Johnson

Chief Engineer, Research Head Appointed by Rockwell Concern

C. B. Johnson has been named chief engineer and E. R. Gilmore, director of research for the Pittsburgh Equitable Meter Division of Rockwell Manufacturing Company. Johnson started with the company as a product engineer in 1929 and in 1941 went to the Pittsburgh-DuBois Company as chief engineer. In 1944 he returned to Rockwell as chief engineer of the Nordstrom Valve Division. He is a member of the American Society of Lubrication Engineers and Society for Experimental Stress Analysis.

Gilmore joined the company in 1936 and has guided the engineering and development of many new products.

Assistant Sales Manager Named For Koppers Chemical Division

Carl H. Pottenger, assistant manager of the plastics department of American Cyanamid Company since 1947, has become assistant sales manager of the Chemical Division of Koppers Company, Inc.

Pottenger formerly was a vice president of the Pennsylvania Coal Products Company of Petrolia, Penn., which was purchased by Koppers in 1947. He will have offices in headquarters of the Koppers Chemical Division in Pittsburgh.

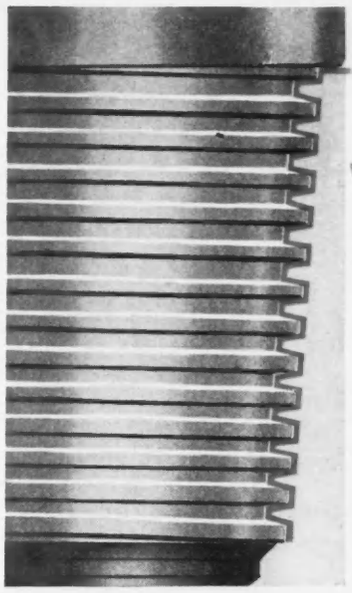
Three Store Management Changes Announced by Continental Supply

Three changes in store management have been announced by The Continental Supply Company:

W. M. Wright, bookkeeper at Graham, Texas, has been appointed store manager, replacing C. A. Ross, who has been transferred to Wichita Falls as manager at that point. He succeeds W. R. Leverett, Jr., who has been moved to Pampa, Texas, in the same capacity. The former Pampa store manager, C. T. Wagner, has resigned.

Rolo Manufacturing Company Enlarges Office and Plant Building in Houston

Rolo Manufacturing Company, manufacturers of Rolo wellcheckers, have recently enlarged their headquarters office and plant building at 2510 South Boulevard, Houston. By the addition of 3600 additional square feet of floor space, Rolo will be able to better serve their customers in the oilfields throughout the world by more rapid delivery of Rolo wellcheckers.



First Line of Defense against GALLED THREADS

WECO No-Gall and WECO Steel-Aid establish an unbroken protective film between mating surfaces . . a metallic film* endorsed by leading manufacturers of drill collars and tool joints as the best defense against galling.

Consisting of powdered metallic bases blended with neutral grease binders and tacky additives, these WECO Thread Compounds require no thinner, never harden, do not squeeze out under high torque and contain no compressible fillers.

For an invulnerable defense against galling, specify WECO No-Gall or WECO Steel-Aid when you buy thread compounds. They provide unequalled protection.

*Opinions of leading authorities are divided between the desirability of lead or zinc as the metallic base. WECO offers both: No-Gall, with 50% pure metallic zinc base; Steel-Aid with 67% pure metallic lead base.

and THREAD LEAKS

WECO Hi-Speed Seal is a permanent defense against thread leaks in casing, tubing, lease lines and all other permanent and semi-permanent threaded connections. It requires no thinner . . seals with less torque . . permits faster make-up and easier break-out and is ready at all times for immediate use.

WECO THREAD COMPOUNDS ARE AVAILABLE AT LEADING SUPPLY STORES EVERYWHERE

ASK YOUR WECO REPRESENTATIVE for all the facts about thread compounds. He can tell you what it takes to completely protect tool joints against the hazards of galling.

WELL EQUIPMENT MFG. CORP.
Subsidiary of Chiksan Company
Houston 1, Texas
Exclusive Sales Representative Outside Mid-Continent Area
CHIKSAN COMPANY
Brea, Calif. New York 7
Export Sales: CHIKSAN EXPORT COMPANY, Brea, Calif. New York 7

WECO
Manufacturers and Distributors of Oilfield, Refining, Marine and Industrial Equipment

What better way to assure yourself of

A Prosperous New Year

than to make sure you have a steady flow of practical time and money saving ideas coming to you each month?

WORLD OIL's specialized coverage of the exploration, drilling, producing and pipe line divisions of the oil industry presents these ideas to you in a complete but compact way.

And you save time by reading WORLD OIL, too, because the sectionalization plan enables you to flip right to the section which has foremost interest for you.

If you are not a subscriber in your own name, use the personal order form below, TODAY!

WORLD OIL

PUBLISHED MONTHLY

Specialized for exploration, drilling, producing, pipe line operations and management

3301 BUFFALO DRIVE • HOUSTON, TEXAS

I want to receive WORLD OIL. Here's my check for

☐ 3 years for $4; ☐ 2 years for $3; ☐ 1 year for $2

NAME_____ POSITION_____

COMPANY_____

STREET & NO._____

CITY & STATE_____

Check branch of industry

☐ Drilling Contractor ☐ Individual Producer
☐ Producing Company ☐ Manufacturing
☐ Pipe Line ☐ Supply

EQUIPMENT and SERVICE SUPPLIERS' NOTES

Permanent Offices Opened in Denver by Core Laboratories

Core Laboratories, Inc., national petroleum reservoir engineering firm, has opened permanent offices in the U. S. National Bank Building at Denver.

James D. Harris

James D. Harris, district engineer, will direct the company's drill cuttings and core analysis activities in the Rocky Mountain area. Permanent laboratory facilities have been established in Worland, Wyoming, and a large part of Core Lab's new equipment now being constructed under a $250,000 expansion program has been designated to service Colorado, Wyoming, and Montana drilling operations.

Republic National Bank of Dallas To Share in Private Wire Service

To provide a more complete service for correspondents, as well as businesses, arrangements have been completed for the inauguration of a private wire service which will link the Republic National Bank of Dallas with banks in key cities from coast to coast.

Established four months ago by the Bankers Trust Company, New York, this nationwide wire service is being expanded to include the Republic National Bank to permit it to communicate with every one of the participating banks in a matter of minutes. The system will be used to handle intercity money transfers, payment orders, fate of collection items, delivery instructions for securities, security purchases and sales, and other bank transactions in which time is a key factor.

Charles E. Edwards Takes Over As Oklahoma Manager for Kobe

Charles E. Edwards has moved from East Texas, where he was district representative, to take over the managership of Kobe's Oklahoma district. He replaces J. T. Lewis, who has been assigned to West Texas. Edwards has been with Kobe since 1939.

Charles E. Edwards

Ralph N. Nelson has been appointed senior district representative in Brookhaven, Miss. Donald B. Ross, has been transferred from Kobe's Mid-Continent Technical Service Section to the General Technical Service Division at Huntington Park. Maury Angerson has been appointed Kobe district representative for the Rocky Mountain district at Rangely, Colo.

NEW Books

Oil-Well Drilling Fluids

Combining under a single cover a compilation of laboratory and field studies of drilling fluids and equipment necessary for their composition, maintenance and utilization, this book by Walter F. Rogers, Houston Chemical Laboratories, Gulf Oil Companies, summarizes the status of the art of handling drilling fluids.

The book is written from the standpoint of the practical mud man, and is equally as useful to the student in petroleum engineering or the chemist who is concerned with the oil well drilling industry's uses of clays and other chemicals in manufacture and conditioning of drilling fluids.

Various chapters cover the relationship between drilling fluids and drilling equipment; testing, with equipment, methods and procedures; specifications for drilling fluid materials; charts and tables for solution of most operational mud problems; viscosity reducing agents; water-clay muds; salt solutions, starch and gum muds; oil-base muds; sodium silicate muds; and prevention of lost circulation.

There is a comprehensive patent literature digest and a bibliography which indicates much collateral reading on the general subject.

Book Department, Gulf Publishing Company, P. O. Drawer 2608, Houston 1, Texas, price $8.

Oil, Gas Conservation

A legal history of oil and gas conservation in the U. S. has been published by the American Bar Association's Section of Mineral Law. It summarizes the legislative, administrative, and judicial activities of each producing state and presents their conservation records.

Almost two years in preparation, the book was prepared by a five-man publication committee headed by Walace Hawkins of Dallas, and edited by Blakely M. Murphy, professor of law at the University of Tennessee. Other members of the committee are Northcutt Ely, Washington; Earl Foster, Oklahoma City; and Robert E. Hardwicke, Fort Worth.

The book is divided into four major parts: (1) "Fundamentals of Reservoir Behavior That Relate to the Conservation of Oil and Gas"; (2) "Legislative, Administrative, and Judicial Concepts of Oil and Gas Conservation as Applied Within the Jurisdiction of the States"; (3) The Interstate Compact To Conserve Oil and Gas and Its Administrative Arm—The Interstate Oil Compact Commission"; and (4) "The National Government and the Conservation of Oil and Gas." Studies of legislative, administrative, and judicial activity relating to oil and gas conservation in 35 producing states are included in Part 2. Monographs in this section were prepared by writers within the various states each of whom had numerous assistants.

Although the final draft of Part One dealing with the reservoir concept was prepared by the committee, the initial research was done by a number of leading petroleum engineers—Dr. John C. Calhoun, Dean W. H. Carson, and N. Van Wingen, of the University of Oklahoma; Dr. Herman Kaveler, Bartlesville; and L. E. Elkins and Gordon H. Fisher, Tulsa. Part 3 was written by Murphy and Part 4 by Ely.

Copies are available from Miss Olive G. Ricker, American Bar Association, 1140 North Dearborn Street, Chicago, Ill.

Air Compressors

Simplified Practice Recommendation R202-48, Tank Mounted Air Compressors, is a revision of a recommendation which was developed in 1943, primarily to conserve scarce and critical materials for the needs of the armed services. It is the purpose of this revision to recognize present day needs by listing the sizes, types, and capacities of compressors that are now in general use.

Superintendent of Documents, Government Printing Office, Washington, D. C. Ten cents.

WITH HELICOPTERS, HERE'S HOW:

1. Transport men and equipment to and from operating locations, faster, cheaper.
2. Operate with much smaller crews. No need for porters, brush cutters, boatmen.
3. Eliminate heavy, expensive equipment . . . quarter-boats, barges, swamp buggies.
4. Avoid expensive personnel turnover, resulting from the physical hardships, haphazard living conditions associated with ordinary ground-anchored seismic marsh operations.
5. Do the whole job by air . . . surveying, drilling, cable laying, geophone planting, shooting and recording. Get crews and equipment into position quick, and keep 'em moving.

Such savings—in money and time—are not just theory, rosy prediction.

For over a year, Bell helicopters have been doing a real job, assisting oil companies to speed their exploration programs. With the full resources of the Bell Corporation behind this work, regional offices have been established in Houston, specialists have been trained, and maintenance crews and pilots equipped to do your work, to your specifications, to your liking. The days of experimentation and proving are past. Call on Bell Aircraft Corporation . . . today.

phone wire write

BELL Aircraft CORPORATION
POST OFFICE BOX ONE BUFFALO 5, NEW YORK

BELL AIRCRAFT CORP.
Regional Office—Phone Atwood 8-4064
714-A M. & M. Bldg., Houston, Texas
Send Full Details
Name
Company
Address

WORLD OIL'S Trading Post

CLASSIFIED ADS

SERVICES · PERSONNEL · USED EQUIPMENT

RATES: Regular Classified (undisplayed) set in this size type: 10 cents per word. If Box Number is to be used count an additional six words. Replies forwarded without charge. Situation Wanted: 5 cents per word. Display advertisements, set in suitably larger type with ruled border: $9.00 per column inch per insertion. Situation Wanted: $4.50 per column inch. **All classified ads payable in advance.** 10% Discount if 3 or more insertions are ordered at one time. **COPY DEADLINE:** 5th of month preceding date of issue. Send copy and checks to: Trading Post Section, World Oil, P. O. Box 2608, Houston, Texas.

HELP WANTED **HELP WANTED**

FOREIGN EMPLOYMENT

In

SAUDI ARABIA

For

Qualified

ENGINEERS

Petroleum • Production • Mechanical • Electrical
Civil • Power
Process • Chemical • Architectural

GEOLOGISTS

Surface Mapping • Sub-surface • Economic

SENIOR PALEONTOLOGIST

ENGINEERS

Triangulation Party Chief • Leveling Party Chief

SURVEYORS

Triangulation • Recorder Triangulation • Precise Leveling

ACCOUNTANTS

Domestic Training Program for young Graduate Engineers prior to foreign assignment. Career employment opportunities. Board and Room furnished. Vacation in U. S. with salary end of each 24 month period. Benefit plans.
If interested apply by letter giving complete employment and personal history.

ARABIAN AMERICAN OIL COMPANY

200 Bush Street, Dept. "F"
SAN FRANCISCO, CALIFORNIA

PERSONNEL AND LABOR RELATIONS

Completely integrated oil company with approximately 1500 to 1700 employees has excellent opportunity to offer the right man—

Age—37 to 43 years.

Experience—Minimum of 5 years in Petroleum Industry in Personnel and Labor Relations, including actual experience in negotiating labor agreements.

Education — College, including some law. Applicant must be Southern born or must have lived in the South for the past 10 years.

Salary—Commensurate with ability and experience.

Address replies to: Box 87W, c/o WORLD OIL, Houston Texas

ENGINEERING POSITION OPEN

The Grayburg Producers Committee is seeking a well qualified Petroleum Engineer to supervise gas injection operations in the North Cowden Field. An experienced engineer is needed to maintain statistical data and to act in an advisory capacity on the operation of this extensive program. This job should offer an excellent opportunity for a person interested in secondary recovery operations in the Permian Basin. **Headquarters will be in Midland, Texas. Write Mr. Tom B. Campbell, Chairman GRAYBURG PRODUCERS COMMITTEE, Box 1540, Midland, Texas.**

READ THE TRADING POST FOR SALES AND SERVICES

HELP WANTED

WANTED: Geologist for supervisory and administrative duties exploration and drilling project Middle East. Should have some experience in seismic and surface work. Age 30 to 45. Address: Box 84W, c/o World Oil, Houston, Texas.

The Production Department of well established growing independent needs a young graduate Petroleum Engineer with one or more years field experience. Time to be devoted to drilling and production. Complete information is desired with first letter, to:

HUSKY REFINING COMPANY
Box 380 Cody, Wyoming

SITUATIONS WANTED

■ CHICAGO EXECUTIVE available for part time responsibility with growing concern maintaining or contemplating Chicago headquarters. Well qualified in accounting, taxation, office and corporate procedures. Address: Box 82W, c/o World Oil, Houston, Texas.

FOR SALE

■ 2-ELI-M5 Seismograph rigs complete. Good condition. Write Charles L. Farris, General Delivery, Wichita Falls, Texas.

■ One 76 Speed Star Drilling Rig Complete. Inquire 438 N. Elm St. or Phone 4141, Henderson, Ky. Dietz Drilling Co.

■ WELL drilling spudders, beams, light rotaries, core drills, tools and casing. Used equipment at money saving prices. Spang and Mills new tools. Leschen lines. Everything for well drilling. Pressey & Son, Pueblo, Colo.

■ Casing pulling machine complete with slips to fit 5½ through 13⅜ casing. In service now. Contact Ideal Casing Company, Box 746 or Phone 134, Wink, Texas.

For Sale
USED COMPRESSORS

20 Ingersoll-Rand Belt Driven, Type 10 COMPRESSOR UNITS:

Two stage 5½ x 10½ - 12″ stroke
Two stage 10 x 18 - 12″ stroke
Single stage size range from 6 x 8 to 17 x 12

For inspection, correspond with or call **South Penn Natural Gas Company,** Parkersburg, West Virginia.

For Sale

Rotary rig Wilson Giant draw works, 90 foot L. C. Moore mast, Wilson-Snyder 6 x 16 pump. Allis-Chalmers L-90 and International 110 H. P. motors. All tools and equipment complete except drill pipe located at Hobbs, New Mexico. All good condition. Immediate delivery. Price $21,500.00 f.o.b. Hobbs. Address Donald Brown, Postoffice Box 1126, Roswell, New Mexico. Telephone 2973.

FOR SALE

■ Smallest, prettiest Miniature Tri-Cone Rock Bit made. Less than ½ inch in diameter. Cones turn. Gold or nickel plate. On Tie Chains, leather strap for watch fobs, and ring type for charms. $5.00 each. Money Order or C.O.D. H. McGaughey, P.O. Box 11063, Houston, Texas.

■ 1600 foot portable rig complete, $11,000.00. Three miles South of Corsicana. L. G. Highnote, Farm Road 709, Corsicana, Texas, Route 3.

For Sale

USED GAS ENGINES

37 - Stationary Gas Engines—2 cycle, with Belt Wheels

Make—Bessemer - Foose

Sizes range from 22 H.P. to 80 H.P.

For inspection, correspond with or call **South Penn Natural Gas Company,** Parkersburg, West Virginia.

FOR SALE: Three 8000′ capacity steam rigs complete with 129′ releg derricks and sub-structure, blowout preventors, drill pipe, and everything ready to put to work. Rigs located at or near Alice, Texas. For further information, write Al Buchanan Drilling Company, 2114 Alamo Nat'l Bldg., San Antonio, Texas, or Frank Buchanan, c/o Al Buchanan Drilling Company, Box 1308, Alice, Texas.

CARDWELL self-propelled drilling and well servicing unit complete with lines and tools. For depths to 4,000 feet. Excellent condition. Address: Box 88W, c/o World Oil, Houston, Texas.

Wilson well servicing unit mounted on International truck complete with line and tools. For depths to 4,000 feet. Excellent condition. Address: Box 89W, c/o World Oil, Houston, Texas.

For Sale

USED PUMPS

19 - Geared, Triplex, Outside Packed PLUNGER PUMPS.

Make—National Transit - Denning - Gould. Sizes—6 x 8, 5½ x 8, 5 x 6, 7 x 10. For inspection, correspond with or call **South Penn Natural Gas Company,** Parkersburg, West Virginia.

FOR SALE: Emsco G-350 Drawworks bought July, 1948. Powered with two D-13000 Cats, but I will keep motors and you can equip with any you desire; or I will sell complete rig with mast. Drawworks designed for three motors. Rig is better than new because it will cost less and is complete with everything needed on rotary drilling rig. Reason for selling, too much rig for work in this area. This equipment will stand inspection. **F. H. Brown Drilling Company, Inc.,** Carmi, Illinois.

FOR SALE

FOR SALE: 3 Used Drilling Rigs located in Kansas and Oklahoma. Two are Diesel electric and one Waukesha powered unit. Complete inventory and prices upon request. **Cities Service Oil Co.,** Patridge, Bartlesville, Okla.

FOR SALE

New Standard Black & Galvanized Pipe

¾" - 1" - 1¼" - 1½" - 2" - 2½" 3½" - 4"

CARLOT QUANTITIES OF A SIZE

Address: Box 85W, c/o World Oil, Houston, Texas.

It's New... Check It!

PIPE GRINDING MACHINE designed and built to give pipe line contractors maximum service in polishing the bevel on plain end pipe in preparation for welding. The machine can be placed on pipe easily and quickly, and will clean the bevel on 24-inch pipe in 15 seconds, whereas a man with file would have to work at least 15 minutes. The grinder is constructed for durability, light weight, effectiveness and economy. Electrically driven, it may be operated from electric welding machines on the line.

The Machine was perfected, and now being manufactured by

WICHITA TOOL REPAIR CO. of Wichita Falls, Texas

Under license from O. R. Hall, inventor.

REAL ESTATE

■ FEE LAND on oil field flanks and oil prospects for sale; also plantations and ranches. W. K. Smith, Box 272, Franklin, Louisiana.

Exchange

HIGH GRADE HOUSTON APARTMENT HOUSING PROJECT

Gross income over $100,000 year

Builder will trade all or portion of newly completed development subject to 4% mortgage for large ranch, producing oil royalties, securities, machinery or assets having substantial cash value. Prefer trade rather than all cash deal. Address: Box 89W, c/o World Oil, Houston, Texas.

FOR RENT

■ For Rent or Lease, 1103 Oak Avenue, Lafayette, Louisiana, 1,600 sq. ft. New Office Building consisting four private offices and one large reception room or office. Completely air conditioned summer and winter. Immediate occupancy. De Clouets, 1305 Oak Avenue. Phone 568.

LEASES, DRILLING, ACREAGE, ETC.

■ SEE A. L. BOWLES, ADA, OKLAHOMA, FOR SHALLOW DRILLING DEALS IN OKLAHOMA.

■ We will buy producing or non-producing oil royalties. Send particulars. Standard Security Co., 115 Broadway, New York 6.

ROYALTIES IN HOT AREAS!

■ Recent strikes have focused attention on Montana's deeper oil zones and major companies are moving in fast, drilling and leasing. We buy direct in the field, sell direct to our customers. Write LANDOWNERS ROYALTIES COMPANY, Box 1225, Great Falls, Montana.

■ TEST well to be drilled in Douglas County, Kansas. Excellent geology. If interested write Box 86W, c/o World Oil, Houston, Texas.

■ DON'T CHARGE OFF minerals or royalty near dry holes as a total loss. We may buy it. Describe fully, state lowest price. Write Kelly Smith, Box 1762, San Antonio, Texas.

Opportunity

FOR YOUNG

Sales Engineer

If you are a young man with some oil industry equipment experience, if you can get along with people and like sales work, if you are willing to work this may be the opportunity you are looking for as Southwestern representative for an established company. Engineering education would be helpful in this work. Members of our company know of this advertisement. Your reply will be confidential and should include information about yourself, your background and experience. Address: Box 90-W, c/o WORLD OIL, Houston, Texas.

NEW CLOSING DATE for The Trading Post

Effective with the October issue, advertisements in The Trading Post section of WORLD OIL must be received by the publisher on or before the 5th of the month preceding date of issue.

WIPE
Sucker Rods
CLEAN!

Here's the compact Sucker Rod Wiper designed as *Well Pullers* wanted it. Short overall height, 4", just right height for wrenching rods. Weight complete, only 36 lbs. Easy to handle, comes mounted on pony rod ready to be used, if so ordered. Tough, natural rubber wiping webs squeegee rod, box and square free of oil. No oil leaves hole or flips on crew...Rubbers stand enough pressure to take oil to tank or sump if well flows. Wipes any size rod—wiping diameter expands from ½" to 2⅜".

The Wiper Housing contains two rubber wiping elements. It is furnished complete to make up on all standard pumping tees. The Plain Cap type is shown above and the Table Plate Head model, below:

The cut away drawing shows sturdy construction of both types. The handy Table Plate Head holds rod tools and elevators.

Write for Catalog 310, code names and complete specifications or see your Patterson-Ballagh man.

Specify PROTECTION PROVEN

PATTERSON-BALLAGH

DIVISION OF BYRON-JACKSON CO.

Sucker Rod Wipers

Main Office: P. O. Box 2493,
Terminal Annex, Los Angeles 54

Offices:
HOUSTON • SAN FRANCISCO
NEW YORK • LONDON • BUENOS AIRES

SQUEAKS from the BULLWHEEL

Hints for Householders

"Daddy and I won't be home tonight, Bobbie. Do you want to sleep alone or with the nurse?"

Bobbie (after some deliberation): "What would daddy do?"

Old for His Age

"I'm at the age now when I can do my best work."

"Why, you're over 70!"

"Well, until I was 70 my stenographer took my mind off my work too much."

The Maiden's Lament

I want the lights that brightly shine.
I want the man, I want the wine.
I want the thrill of a long-drawn kiss.
I want all the things that good girls miss.
What I really want is some good advice
On how to be naughty and yet be nice.

Haunted Heart

Two gangsters were escorting a member of a rival gang across a lonely field on a dark rainy night.

"What rats youse guys are," groaned the doomed one, "making me walk through a rain like this."

"How about us?" growled the escort. "We gotta walk back."

Word to the Wise

"This perfume comes in 3 different strengths—No. 1 'Fragrance of a First Kiss.' No. 2 'Wedding in June' . . ."

"What's the No. 3?"

"One Man's Family."

She's a She, Though

"Where did you get that date? Buck teeth, crossed eyes, bow legs, bleached hair!"

"You needn't whisper, old man. She's deaf, too."

Hold Everything

"I married an adagio dancer. We've been married three weeks and I haven't kissed her yet."

"Don't you love her?"

"Sure, but I can't catch her!"

The Great Event

"You think so much of your old golf game that you don't even remember when we were married."

"Of course I do! It was the day I sank that 30-foot putt."

Same Old Story

The students of a girls' high school were asked to do a book review on a novel they had read the previous month. One girl waited almost until the deadline, borrowed a book from the circulating library, and turned in the following:

"'Pink Jajamas,' by Hannah Heartthrob, is a modern novel of young love. The theme is the familiar 'boy meets girl.' He doesn't care for her in the beginning but he finds out that she's really marvelous in the middle and so he marries her in the end."

Who's Who

"As I was crossin' a bridge the other day," said an Irishman, "I met Pat O'Brien. 'O'Brien,' says I, 'how are you?' 'Pretty well, Brady, thank you.' 'Brady,' says I, 'that's not my name.' 'Faith!' says he, 'and mine's not O'Brien.'

"With that we looked at each other again and sure enough it was nayther of us."

Bare Facts

"She don't look good in nothing," sneered the chorus girl.

"You should not say that," corrected the stage manager. "Say 'she looks good in nothing.'"

"Naw," replied the chorus girl, "that ain't what I mean."

PETROLEUM ENGINEERS
CABLE & STINE
WICHITA FALLS, TEXAS

EXPERIENCED PRACTICAL
AND TECHNICAL CONSULTING
PRODUCTION ENGINEERING
SERVICE

•

SPECIALIZING
in
MODERN
SECONDARY
RECOVERY

NEW BOOK

COMPOSITION AND PROPERTIES
OF OIL WELL DRILLING FLUIDS
See Page 8 for Full Description
Price $8.00
Book Department
GULF PUBLISHING COMPANY
P. O. Box 2608, Houston 1, Texas

McCullough

GOES ANYWHERE—ANY TIME TO DO

YOUR FISHING JOBS

with the

FINEST FISHING TOOLS

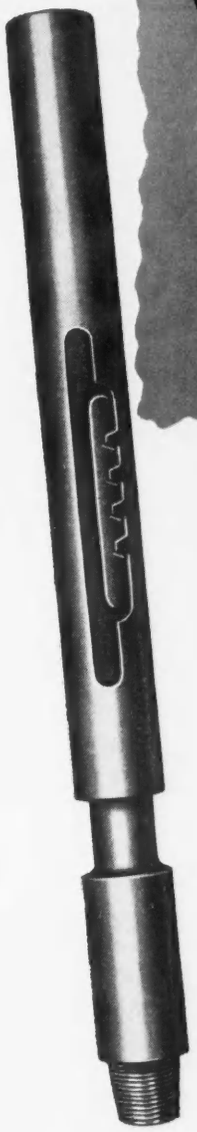
•

POSITIVE KNOWLEDGE

of just where pipe is stuck, and

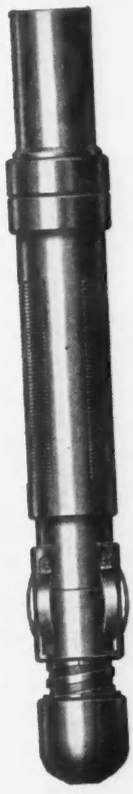
•

THOROUGHLY EXPERIENCED MEN

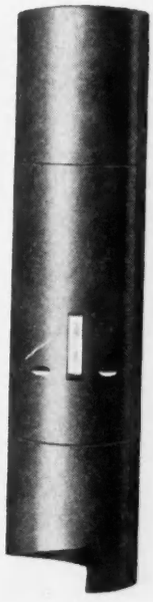


Double-Acting ROTARY JAR Strikes Blows Both UP and DOWN

Rotary Releasing SOCKET



Rotary Releasing SPEAR



Self-Feeding EXTERNAL CASING CUTTER

BUMPER SUB

The MAGNA-TECTOR shows just where pipe is stuck

Long Knife Internal CASING CUTTER

McCullough TOOL COMPANY

5820 South Alameda St., Los Angeles 11, California
405 McCarty Avenue, (P. O. Box 2575) Houston, Texas

26 SERVICE LOCATIONS

TEXAS: Houston, Alice, Cisco, Corpus Christi, McAllen, Odessa, Tyler, Victoria, Wichita Falls, San Angelo

OKLAHOMA: Oklahoma City, Guymon, Healdton

MISSISSIPPI: Laurel

NEW MEXICO: Hobbs

KANSAS: Ulysses

CALIFORNIA: Los Angeles, Avenal, Bakersfield, Ventura

MONTANA: Cut Bank

LOUISIANA: Houma, Lake Charles, New Iberia, Shreveport

WYOMING: Casper

EXPORT OFFICE: 30 Rockefeller Plaza, New York 20, N. Y.

Standco
NO-SMOKE

STANDCO BRAKE LINING
Stands the gaff and gets the job done without scoring brake rims. See pages 3973-3978, Composite Catalog.
Standco Brake Lining Co.
HOUSTON

New Oil Well Casing
50,000 Ft.
For sale for immediate delivery 5½", J-55, 14 lb., range 2, T&C. 35,000 ft. are in Houston. 15,000 ft. in Southern Illinois.
Also 6,400 ft. 2" ID seamless tubing T&C.
For further information write or call
NORTHWESTERN REFINING CO.
ST. PAUL, MINN.

Gravity Surveys
COASTAL OIL FINDING COMPANY
Established 1928
ESPERSON BLDG. HOUSTON, TEXAS

—SPRINGS—
Let Us Quote You.
Send Sample or Prints.
J. W. JOHNSON, Repr.
RAYMOND MFG. CO.
6019 Winton Dallas 6, Texas

THE FORT WORTH LABORATORIES
Analysis of oil field brines, cores, gas, oil and minerals. Field gas testing. Long Distance 138. 823½ Monroe Street, Fort Worth, Texas.

W. P. JENNY
Consulting Geologist and Geophysicist
AERIAL MAGNETIC AND MICROMAGNETIC SURVEYS AND INTERPRETATIONS
GEOPHYSICAL CORRELATIONS
Charter 4-4777 Lehigh 0940
1404 Esperson Bldg. HOUSTON, TEXAS

NEW BOOK
COMPOSITION AND PROPERTIES OF OIL WELL DRILLING FLUIDS
See Page 8 for Full Description
Price $8.00
Book Department
GULF PUBLISHING COMPANY
P. O. Box 2608, Houston 1, Texas

SQUEAKS from the BULLWHEEL

R-R-Rough

Two drillers were having lunch together. One of them asked the waitress: "What is good beginning with R?"

"R-R-Roast beef, sir."

"What vegetables go with it?"

"R-R-Rutabagas."

"What's good for dessert?"

"R-R-Raisin pie."

As the waitress walked away one of the drillers remarked to the other: "She sure rolls her R's, doesn't she?"

The waitress turned around to them: "I know—it's these darned shoes."

That Stopped Her

A lady on a Pullman was annoyed by the snoring of a man in the upper berth. Exasperated, she knocked on the ceiling of her sleeper. Finally the man stopped snoring and called, "I saw you come in and I'm not coming down."

For Women Only

The only thing you can pick up with long skirts is dirt.

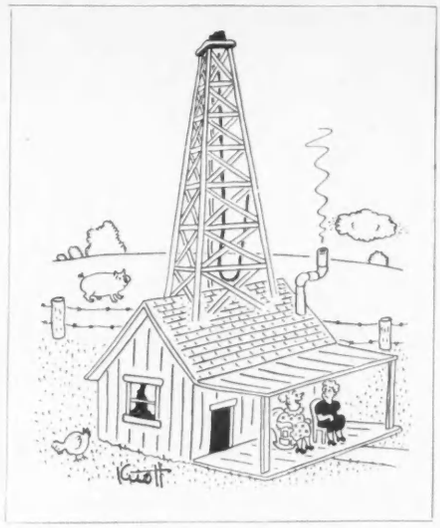
Walk in the Moonlight

You haven't ever proved
If you're a man or a mouse
Until you've wintered where
Plumbing's outside the house.

Up and Around

"As I understand the case," said the judge, "you and your husband had a drunken altercation and you were kicked in the ensuing rumpus."

"Nossuh. Ah was kicked in de stummick!"



"We just couldn't bring ourselves to give up the old homestead completely."

Progress

"What is your profession?"

"Agricultural expert."

"What was your father?"

"Farmer."

"And your grandfather?"

"Peasant."

Clean Joke

"Where do you take a bath?"

"In the spring."

"I said where, not when!"